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Flap-Lag Stability Data for a Small-Scale Isolated Hingeless Rotor in Forward Flight

Michael J. McNulty

April 1989

National Aeronautics and Space Administration

US ARMY AVIATION SYSTEMS COMMAND
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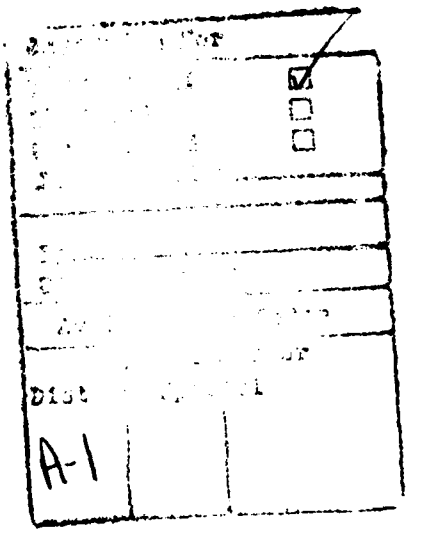

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SUMMARY

An isolated, hingeless rotor with discrete flap and lead-lag flexures and relatively rigid blades was tested in the Aeroflightdynamics Directorate's 7- by 10-Foot Wind Tunnel. The purpose of the test was to determine experimentally the lead-lag stability of a structurally simple rotor configuration in forward flight. The model tested had no cyclic pitch control, and was therefore operated untrimmed at several collective pitch angles, at shaft angles from 0° to −20°, and at advance ratios as high as 0.55. Two inplane natural frequencies, 0.61/rev and 0.72/rev, were tested for configurations both with and without structural flap-lag coupling. Concomitant hover testing of the model was also conducted. Representative plots of the frequency and damping data are presented to show general trends, and complete tabular data and model properties information are included for use in detailed correlation studies. The most prominent feature of the forward flight data is an abrupt increase in damping with advance ratio at certain high-speed, high shaft-angle conditions, with high flapping loads. The hover data are consistent with previous experimental and theoretical results for hingeless rotors without kinematic couplings. Overall, the data quality is very good and the data are expected to be useful in the development and validation of rotor aeroelastic stability analyses.

NOMENCLATURE

$B.S.$	blade station, from center of rotation, in.
c_d	airfoil drag coefficient
c_l	airfoil lift coefficient
α	airfoil angle-of-attack, to chord line, rad
α_s	rotor shaft angle, negative for forward tilt, deg
μ	advance ratio
σ	damping exponent, 1/sec
θ_0	blade collective pitch angle, to chord line, deg
ω	natural frequency, Hz
Ω	rotor speed, rpm

INTRODUCTION

The general problem of predicting rotorcraft aeromechanical and aeroelastic stability encompasses an array of analytical challenges. Structural dynamic complications include significant geometric nonlinearities, geometric stiffness, coupling between the rotor and the

nonrotating system, configurations with redundant load paths, and the widespread use of composite and elastomeric materials. Aerodynamic complications include rotor wake effects, nonlinear airfoil effects, transonic flows, and rotor-body aerodynamic interactions; all of which are, for the stability question, unsteady phenomena, and all of which may exist both in hover and forward flight. An additional complication whose importance promises to increase in the future is the effect of active controls. Developing an analysis which will accurately deal with all of these effects for an arbitrary rotorcraft configuration at any operating condition is a formidable task.

Specialized investigations of simple configurations and restricted flight conditions can emphasize the effects of one complicating factor and minimize the effects of others. For such cases, systematically comparing the results of various analyses with appropriate experimental data sets can give insights into the fundamental dynamic behavior of rotorcraft, as well as expose the specific strengths and weaknesses of the analyses. A number of such investigations have been conducted, and cases for which experimental data are available include: an isolated (*i.e.*, the hub is fixed rigidly in space) torsionally soft elastic blade both in a vacuum (ref. 1), and in hover (ref. 2); an isolated hingeless rotor with rigid blades, flap- and lead-lag degrees of freedom, and various aeroelastic couplings in hover (refs. 3 and 4); a coupled hingeless rotor-body with rigid blades and discrete flap and lead-lag flexures, both under simulated vacuum conditions and in hover (ref. 5); and a simple isolated bearingless rotor in hover (ref. 6).

None of the investigations above deals with the effects of forward flight; the present work was intended to examine this area. Theoretical work has indicated that forward flight can have large effects on blade flap-lag stability (refs. 7 and 8), but a lack of experimental data has hampered the validation and refinement of those results. Coupled rotor-body stability data in forward flight are available (ref. 9), but isolated rotor flap-lag stability data are lacking. Although rotor-body testing more closely represents actual rotorcraft in flight, isolated rotor studies are probably even more valuable for examining the effects of forward flight because there are no body coupling effects present to obscure the results. Rotor-body coupling is a relatively tractable problem which can be dealt with separately. The primary objective of the research reported here was to obtain a set of isolated rotor flap-lag stability data in forward flight for correlation with existing and future analyses. Whereas all of the isolated rotor tests referred to above used two-bladed rotors, for this experiment a three-bladed rotor was chosen, in part so that the role of dynamic inflow (ref. 10) in isolated rotor flap-lag stability could be assessed.

This report presents an extensive set of experimental aeroelastic stability data and supporting documentation for the specialized case of an isolated rotor in forward flight. The model tested was a three-bladed, soft-inplane, hingeless rotor with discrete flap and lead-lag flexures and relatively rigid blades. The model structural configuration and control system were kept as simple as possible to more effectively isolate the effects of forward flight aerodynamics on lead-lag damping. The test was conducted in the Aeroflightdynamics Directorate's 7- by 10-Foot Low Speed Wind Tunnel at Ames Research Center. Two nominally identical rotor models were tested, Rotor I and Rotor II. Rotor I was tested extensively in hover, and

then tested in forward flight up to very high flapping conditions at a single rotor speed and a single collective pitch angle. When the flexures of Rotor I exceeded their fatigue life, a second set of flap and lead-lag flexures was installed with the blades on the hub, which gave Rotor II. Although Rotors I and II were identical in design, due to manufacturing differences the flap and lead-lag flexures of Rotor II gave slightly different fundamental frequencies than did Rotor I. Rotor II was tested in forward flight at two rotor speeds, and three collective pitch angles, both with and without structural flap-lag coupling, but it was restricted to less extreme flapping conditions than Rotor I. Only limited hover testing was conducted with Rotor II. Although the differences between Rotor I and Rotor II data are quite small for otherwise identical conditions, the rotor used is specified for each datum presented. Some of the data presented here have previously been published and compared to analytical predictions of lead-lag damping based on both linear (ref. 11) and nonlinear (ref. 12) quasi-steady aerodynamic theories.

This data report describes the model, instrumentation, test procedures, and data analysis techniques used for the experiment; presents representative plots of the data obtained; and includes complete tabulations of the data for use in future correlations with analyses.

EXPERIMENT DESCRIPTION

Model Description

A photograph of the rotor hub and blades installed on the model is shown in figure 1. Considerable analytical research has been conducted using the simplifying representation of a hingeless rotor as a set of rigid blades with offset, coincident, spring-restrained flap and lead-lag hinges, (ref. 7); the model tested was designed to closely approach this simple analytical idealization. To accomplish this the model used lead-lag and flap flexures, shown in an exploded-view drawing in figure 2. Two stiff "side beams" attached the outboard end of the single element lead-lag flexure to the inboard end of the double-element flap flexure so that the lead-lag and flap flexural webs were both centered at 11% of the rotor radius. The flap flexure was very stiff in the lead-lag direction and the lead-lag flexure was very stiff in the flap direction. Both flexures were designed to be as stiff as possible in torsion so as to minimize elastic pitch motion inboard of the blade root. The measured torsional stiffness of the flexure assembly was 215 in-lbs/radian, which gave a nonrotating fundamental blade-torsion frequency of 149 Hz. This value is equal to 9/rev at the highest rotor speed tested.

The model had no cyclic pitch control, and the collective pitch angle was set manually prior to operation. This resulted in trim conditions with unrestricted cyclic flapping, and which satisfied no particular force and moment requirements. Rotor flapping flexure strain allowables determined the limits of the shaft angle versus advance ratio test envelope at a given collective pitch. While these are not normal rotorcraft operating conditions, they do

represent well defined and challenging conditions for analytical validation and development exercises. Eliminating the swashplate and pitch bearings minimizes control slop and friction damping, which allows higher quality model-scale dynamic data to be obtained than would be possible otherwise.

The model incorporated means for varying the amount of structural coupling between the flap and lead-lag motions of the blade, an important factor in hingeless rotor aeroelastic stability (ref. 3). This was accomplished by setting the collective pitch either by rotating the blade relative to the blade socket, giving essentially no flap-lag structural coupling, or by rotating the entire flexure assembly and the blade along with it, relative to the hub adaptor, giving full flap-lag structural coupling. These two possible pitch-change locations are identified in figure 2. The flexure-blade assemblies were mounted to the hub so that, when the flap and lead-lag angles were zero, the line along the blade quarter-chord was normal to the rotor shaft and passed through its center.

Figure 3 shows the details of the blade planform and cross section. The blades were composed of stiff Kevlar spars with tantalum leading edge weights for chordwise mass balance, balsa wood cores, fiberglass reinforcement at the trailing edges, and fiberglass overwraps for torsional stiffness. The blades were untwisted and untapered, with the root cutout at 18.6% and the NACA 23012 airfoil section beginning at 24.8% of the radius and continuing to the tip. The elastic axis, pitch axis, and axis of section mass centers were all located at the quarter chord. The blades were much stiffer than the flexures in both the flap and lead-lag directions so that rigid-body blade motions about the flexures would accurately represent the rotor's fundamental flap and lead-lag modes. With the blade root socket clamped to a backstop, the first flap and lead-lag frequencies of the blades alone were measured as 9.5 and 33 Hz, respectively, and the second flap frequency was 59 Hz. The first torsion frequency of the blade without flexures was estimated to be greater than 200 Hz.

Previous model-rotor testing experience has shown that even relatively small differences in properties from one blade to another can result in very poor data quality in isolated blade stability tests of rotors with three or more blades. This problem was dealt with by very carefully matching the blade inertias and flexure stiffness to each other. Before being instrumented, the flexures for each rotor were honed by hand so that they all had the same flap and the same lead-lag frequencies when each was mounted with the same blade. Then, after the flexures were instrumented, a small variable tip mass in each blade, located on the quarter chord, (see fig. 3) was adjusted so that each flexure-blade assembly had the same lead-lag frequency as the others. The result was that with the model installed in the wind tunnel the maximum nonrotating frequency difference between blades was approximately 0.5%. Reference 13 examines the effects of blade-to-blade dissimilarities.

The principal geometric properties of the rotor and mass and stiffness properties suitable for use in rigid blade analyses are given in table 1. The values given are all measured, except for the torsional inertia and the flap and lead-lag inertia. The torsional inertia was computed from the measured torsional frequency and the measured stiffness. The flap and lead-lag inertia was calculated from the blade and flexure mass distribution. The given mass

properties include only the mass outboard of the center of the flapping flexure; no lead-lag flexure or side beam mass is included. The nonrotating frequency values in table 1 are the most reliable measurements of the set; it is therefore suggested that analysts adjust the flap and lead-lag flexure stiffnesses as needed to yield the given frequencies. The flap and lead-lag frequency differences between Rotor I to Rotor II are caused by variations in the manufacturing process. These frequency differences could be due to variations in the flexure web thicknesses of less than 0.001 inches. The change in nonrotating flap damping from Rotor I to Rotor II results from a change in the way the instrumentation leads were routed off the flexures. In general, the nonrotating damping measurements were quite variable, ranging from -0.070 to -0.120 for the lead-lag mode, dependent primarily on the amplitude of the excitation; the values given are averages for excitation levels typical of those used when the rotor was operating.

An exploded view of the flexure and blade assembly has been included as figure 2. Figures 4 through 6 show the details of the lead-lag flexures, the side beams, and the flap flexures, respectively. These drawings and material properties from reference 14 were used to calculate the running mass per unit length, torsional inertia per unit length, flap bending stiffness, lead-lag bending stiffness, and torsional stiffness for each of these components. The results are given in tables 2 through 4. The given torsional stiffness values include the effects of warping restraint at both ends of the thin webs of the flap and lead-lag flexures . The radial distributions of these properties for the blade, including the root socket, were taken from reference 15 and are included here as table 5.

Because actual lift and drag data for the NACA 23012 airfoil is unavailable at the low Reynolds numbers appropriate for a small-scale, low tip-speed test, steady-bending-moment data from a test with the same blades used in the present test has been used to estimate the airfoil characteristics (Bousman, William G., The Effects of Structural Flap-Lag and Pitch-Lag Coupling on Soft Inplane Hingeless Rotor Stability in Hover, NASA Technical Paper, to be published). The results are

$$c_d = 0.0079 + 1.7\alpha^2$$

$$c_l = 0.15 + 5.73\alpha$$

These results apply for positive angle-of-attack below stall, and may be useful for correlations with the hover results of the present test. The forward flight conditions of the present test, however, often involve large negative angles-of-attack over significant portions of the rotor disk, and so the expressions above are less useful. Instead, published airfoil data for higher Reynolds numbers might be used, perhaps corrected for low Reynolds number effects.

A photograph of the model installed in the Aeroflightdynamics Directorate's 7- by 10-Foot Wind Tunnel is shown in figure 7. Side- and front-view diagrams of the installation are shown in figure 8. The rotor stand included a gimbal which allowed the upper stand, enclosed by the fuselage fairing, to roll relative to the lower stand. This roll motion results

in lateral translation of the rotor hub which excites the blades' lead-lag motion. A push rod and an arm extending from the side of the upper stand connected it to a 50-lb electromechanical shaker, located next to the base of the lower stand, which could drive the gimbal roll motion. The gimbal motion could be locked out by a hydraulic brake. The stand and shaker were mounted on a base plate located under the tunnel floor. The base plate was attached to the wind tunnel structure by a hinge at the front and an electric actuator at the rear which could pitch the entire assembly forward, thereby controlling the rotor shaft angle. Shaft angles from 0° to −20° could be obtained. At a given collective pitch angle, rotor speed, and advance ratio, varying the shaft angle was the only means available to control the rotor loads. With the shaft vertical, the rotor plane was 38 inches above the wind tunnel floor.

The rotor stand was designed to be as stiff as possible so that the rotor dynamic data would be representative of isolated rotor results. The lowest natural frequency of the stand, with the brake locking out the roll gimbal, was found to be about 25 Hz. This is nearly four times greater than the rotor lead-lag regressing mode frequency at 1000 rpm, but is slightly less than the lead-lag progressing mode frequency at that rotor speed.

Instrumentation

For each blade, the flap and lead-lag bending moments at the flexure center were measured with strain gage bridges. Each flap flexure was also instrumented with a torsion moment bridge at the outboard end of the web. For Rotor II additional flap and chord bridges were installed at the inboard and outboard extremes of the webs of one flexure set so that the bending moment distributions could be monitored. These signals were routed from the rotor hub through a slip ring to the nonrotating system. A Hall-effect 1/rev sensor was used to determine the rotor speed and establish a blade azimuth reference. A 60/rev signal was also used to give the rotor operator a continuously updated rotor speed measurement. The wind tunnel dynamic pressure and the rotor shaft angle were also measured with standard instruments. Accelerometers were also installed in both the fixed and rotating systems to help resolve any uncertainties that might arise regarding rotor-body coupling.

The signals from the strain gages, accelerometers, 1/rev sensor, and, for Rotor II, the dynamic pressure and shaft angle transducers were low-pass filtered to 50 Hz for anti-aliasing, amplified, and then digitized by a computer controlled data aquisition system. For Rotor I data, the shaft angle and dynamic pressure were simply recorded manually. The strain gage signals were also displayed on oscilloscopes so that rotor loads could be continuously monitored.

Test Procedures

The pitch of each blade was set with the aid of a small bubble level before each run. Small adjustments to the pitch of each blade were then made until the rotor tracked at the

operating rotor speed in hover. In general, the track did not depend on the rotor speed, but it did deteriorate with increasing advance ratio. After the rotor was established at operating speed, the wind tunnel was started and the dynamic pressure increased to give the desired advance ratio. The rotor shaft angle was adjusted as needed to control the rotor loads during the process. With the rotor and wind tunnel stabilized at the test condition, the hydraulic gimbal brake was released and the shaker used to drive the upper stand in roll at the appropriate fixed system rotor lead-lag frequency, progressing or regressing as desired. When sufficient excitation was evident on the oscilloscope displays of the lead-lag bending gages, the shaker was stopped, the brake engaged to lock up the upper stand, and the data aquisition system triggered to record the ensuing transient. At least two separate records were taken at each test condition so that the repeatability of the measurements could be assessed. A total of over 2000 damping measurements were made.

Data Analysis

Each record consisted of 5.12 seconds of data, digitized at a sample rate of 100 Hz. The multiblade coordinate transform was then used to transform the recorded individual blade signals to the nonrotating system, using azimuth information from the 1/rev signal. The resulting multiblade sine or cosine lead-lag coordinate time history was then analyzed with spectral and moving-block techniques (ref. 16) to determine the frequency and damping of the progressing or regressing lead-lag mode. The details of the implementation of these analyses are described in reference 17. While the analyses could have been performed on any of the individual lead-lag signals, the use of the transformed signals generally resulted in a higher signal-to-noise ratio, and it clearly separated the rotor regressing and progressing modes from each other. The importance of this separation will be discussed below.

RESULTS

The set of lead-lag regressing mode frequency and damping data obtained in forward flight is the primary result of this investigaton. Data were also obtained in hover.

Hover

The collective pitches and rotor speeds that define the hover test points are shown in figures 9(a) and (b), for the configurations with and without structural flap-lag coupling, respectively. Complete tabulations of the regressing lead-lag mode stability data in hover are given in table 6 for the configuration without structural coupling and in table 7 for the configuration with structural coupling. The identifying number of the rotor tested, collective pitch, rotor speed, shaft angle, and an identifying data point number are given along with the measured regressing-mode frequency and damping. Each table is sorted by increasing

collective pitch and rotor speed, decreasing shaft angle, and increasing rotor number. At zero collective pitch the two rotor configurations are identical, so some data points are included in both tables 6 and 7.

The fixed system lead-lag frequencies and damping values at zero collective pitch are plotted as a function of rotor speed in figure 10. The 2/rev frequency separation between the progressing and regressing modes is as expected for isolated rotor data. The small difference in nonrotating frequency between Rotor I and Rotor II is the cause of the consistent spread in the regressing mode frequency data, but for each rotor the actual data scatter is practically zero. For a truly isolated rotor, any differences in damping between the progressing and regressing mode results can be caused only by blade-to-blade coupling through the rotor wake. The small damping differences seen in figure 10 between the progressing and regressing mode damping values at the lower rotor speeds may be due to wake effects, but the differences seen at the higher rotor speeds are clearly too great for this explanation. These damping differences at high rotor speeds indicate that the rotor lead-lag progressing mode was coupling with the stand. This is not surprising since the progressing mode frequency at 1000 rpm approximately equals the frequency of the lowest stand mode. For rotor speeds above approximately 600 rpm, the progressing mode data are not representative of an isolated rotor.

The most important conclusion from figure 10 is that the regressing mode data show no signs of contamination by rotor-body coupling at any rotor speed. This shows the advantages of using a rotor with three or more blades for isolated rotor dynamics tests. *Distinct* progressing and regressing modes do not exist for rotors with less than three blades, and, due to the periodic coefficients of the governing differential equations, a single blade mode with the frequency ω in the rotating system will appear in the nonrotating system at the two frequencies $\Omega + \omega$ and $\Omega - \omega$ simultaneously. Any blade motions therefore will couple with the stand at both these frequencies, and any proximity of the high frequency manifestation of the blade mode (at $\Omega + \omega$) to a stand natural frequency will equally contaminate the low frequency manifestation (at $\Omega - \omega$). For the present stand and blades, at rotor speeds above 600 rpm any two-bladed rotor data would have been contaminated regardless of whether the excitation was at $\Omega + \omega$ or $\Omega - \omega$. Bousman, in the paper mentioned earlier, suggests that, for a two-bladed rotor to represent the isolated rotor case, the lowest stand natural frequency should be several times $(\Omega + \omega)$. With three or more identical blades, distinct progressing and regressing rotor modes exist and so any coupling of the progressing mode with the rotor stand does not affect the regressing mode; therefore the necessary condition for a model to correctly represent an isolated rotor is that the the lowest stand frequency be several times greater than the regressing mode frequency. The present model fulfills this requirement.

Even with three blades, the impulsive locking of the roll degree of freedom following the shake input excites the progressing mode to some degree, even when the model is excited in roll at exactly the regressing mode frequency. The pure regressing mode data can then be extracted only by making use of multiblade coordinates. In practice the single blade signals were usually found to give acceptable results when the excitation level was high relative to

the response to the locking impulse and to the background noise. The multiblade coordinate results were, however, consistently better, based on the appearance of the time histories and the moving-block functions, and were less sensitive to the details of the excitation. The only disadvantage associated with using the multiblade coordinates is the requirement that each blade be instrumented.

Only the regressing lead-lag mode data will be considered further. Figure 11 shows the regressing mode damping as a function of rotor speed for collective pitches of 0°, 4°, 6°, and 8° for the configuration without structural coupling. Figure 11(a) shows that at zero collective pitch the Rotor II damping is lower than that of Rotor I, but the differences are small except at the lower rotor speeds. Those differences may be related to the lower nonrotating flap damping in Rotor II. The damping is generally seen to increase with increasing rotor speed, except for the decrease between 350 and 400 rpm. This decrease grows with increasing collective pitch, and is associated with the coalescence of the flap and lead-lag frequencies (ref. 3).

The regressing mode frequency measured without structural coupling is shown to be essentially independent of the collective pitch angle in figure 12. The regressing mode frequency results obtained with full structural coupling (not shown here) are essentially identical.

The regressing mode damping as a function of the collective pitch is shown in figures 13 and 14 for the configurations without and with structural coupling. For each configuration data are given for both 750 and 1000 rpm; these are the rotor speeds at which the forward flight data were taken. The dimensionless rotating lead-lag frequencies at these rotor speeds are 0.72 and 0.61, respectively. The increase in damping with collective pitch is as expected for soft-inplane hingeless rotors, without kinematic couplings, away from the flap-lag frequency coalescence.

The hover testing was conducted in a relatively small test section with the rotor only 0.6 diameters above the floor. Even for this small separation, there are several factors that indicate that the influence of ground effect and recirculation on the damping data is minor. Most convincing are the model tests with ground planes reported in reference 2. These tests showed that the ground planes had little influence on lead-lag damping, even for very small separations between the rotor and the ground planes. The second factor is evident from a comparison of the Rotor I and the Rotor II hover results to each other. The Rotor I hover testing was conducted with the wind tunnel test-section doors open and the windows removed to reduce recirculation, while the Rotor II hover testing was conducted with the doors closed and the windows installed. The recirculation present is certainly very different for these two situations, although neither closely represents a free air hover test. If recirculation were a major factor, then the data from the two rotors would be expected to show differences that increase significantly with increasing blade pitch. Figure 13, however, shows such differences to be small.

In general, the hover data quality, as judged by the small scatter in the results and the appearance of the time histories and moving-block functions, is very good. Figure 15 shows sample time histories of the cosine lead-lag coordinate and the resulting moving-block

functions at the regressing mode frequency for the hover cases at 1000 rpm, with collective pitches of 0°, 4°, and 8°. The ideal moving-block function is a straight line, whose slope is equal to the damping exponent, with small oscillations at twice the analysis frequency superimposed (ref. 17). The 0° and 4° cases (figs. 15(a) and (b)), show nearly ideal results, while the 8° case (fig. 15(c)) shows a somewhat degraded but still very good moving-block function. These results are typical of the hover data. The degradation of the moving-block function at higher collective pitches is the result of a decreased signal-to-noise ratio, due both to increased noise from recirculation, and a lower average signal, due to the higher damping of these cases. The degradation manifests itself in the damping data as increasing scatter with increasing collective pitch.

Forward Flight

Forward flight testing was conducted at rotor speeds of both 750 rpm and 1000 rpm, for the configurations both with and without structural coupling, at collective pitch angles of 0°, 3°, and 6°. The conditions tested without structural coupling are summarized in figures 16 and 17. Figures 18 and 19 summarize the conditions tested with structural coupling. At each advance ratio, the high negative-shaft-angle limits were set by large negative coning loads, while the low shaft angle limits were set by high cyclic flapping loads. The data available for $\theta_0 = 6°$ are quite limited due to the high cyclic flapping loads, and therefore the effects of structural coupling in forward flight were not thoroughly explored by this test. Only the results for the configuration without coupling will be discussed herein, but the results obtained both with and without coupling are included in tabular form. Tables 8 and 9 present the data for the configuration without structural coupling at 750 and 1000 rpm respectively, sorted by collective pitch, advance ratio, and shaft angle. Tables 10 and 11 are the corresponding tables for the configuration with structural coupling.

Figures 20 through 25 show the regressing lead-lag mode damping as a function of the advance ratio for the 750 rpm rotor speed, for rotor shaft angles of 0°, −4°, −8°, −12°, −16°, and −20°, respectively. Figures 26 through 31 show the corresponding results at 1000 rpm. Each figure shows all of the data available at each collective pitch tested. The data for Rotor I are limited to the 1000-rpm, zero-collective cases, but includes advance ratio-shaft angle combinations that resulted in higher flapping conditions than Rotor II encountered. Overall the data scatter is small, and in all cases where data from both rotors are available, they agree very well with each other.

Significant changes in the damping at the high advance ratios are seen in figures 28 through 31 at zero collective pitch. The abrupt damping increases begin at lower advance ratios for more forward shaft angles, and are seen only at the high flap load conditions which only Rotor I encountered. In particular the increases appear related to high negative coning conditions, however, no flapping angle or thrust measurements are available for correlation. At these conditions large negative angles-of-attack are encountered over large regions of the rotor disk. The data at the higher collective pitch angles were limited to lower load levels, and do not show similar increases within the test envelope.

The effects of changing rotor shaft angle at fixed advance ratios are shown in figure 32. Results are shown for advance ratios of 0.05, 0.15, 0.25, 0.35, 0.45, and 0.55. Data from both rotors are included without distinction. The large damping increases with forward shaft tilt are again seen at the zero-collective pitch, high speed conditions. The higher advance ratio cases show the increase to begin at less extreme shaft angles.

No special problems were encountered using the moving-block analysis on the forward flight data, and in most cases very good results were obtained. As in hover, the more highly damped conditions tended to show more scatter in the results than did the less stable conditions. Wind tunnel turbulence was an additional noise source, but this was offset to some extent by the reduced recirculation. The addition of 1/rev and 2/rev lead-lag loads due to forward flight also restricted the excitation levels allowable within the lead-lag flexure load limits, but this was not a major factor. Sample transient time histories of the multiblade cosine coordinate of the lead-lag motion in forward flight and the resulting moving-block functions at the regressing mode frequency are shown in figure 33 for $\alpha_s = 0°$, and in figure 34 for $\alpha_s = -10°$. Both figures are for $\theta_0 = 0°$ and advance ratios of 0.15, 0.35, and 0.55. All the moving-block results of figure 33, and those of figure 34(a) and 34(b) are very good. These are all relatively low-damping, low-flapping conditions, and the effects of forward flight alone are not troublesome. The $\mu = 0.55$, $\alpha_s = -10°$ case of figure 34(c), however, shows a somewhat degraded moving-block function. This is a high flapping load case and was one of the most highly damped cases found in forward flight, so the degradation is not surprising. The moving-block function for this case is probably the worst encountered during the entire test, and it is still quite acceptable.

SUMMARY OF RESULTS

An isolated hingeless rotor with discrete flap and lead-lag flexures, relatively rigid blades, and high torsional stiffness was tested in the Aeroflightdynamics Directorate's 7- by 10-Foot Wind Tunnel. The objective of the test was to obtain a database of isolated rotor flap-lag stability in forward flight for correlation with current and future rotorcraft stability analyses. The model was tested at advance ratios up to 0.55, for three values of collective pitch, and for shaft angles from 0° to −20°. Two inplane natural frequencies, 0.61/rev and 0.72/rev, were tested for configurations with and without structural flap-lag coupling. Specific findings include

1. The use of a simple model with no swashplate or pitch bearings eliminated control system slop and reduced friction damping to a minimum, and this, together with careful blade-to-blade matching, was largely responsible for the high quality of the test data. The use of a three-bladed rotor, rather than a two-bladed rotor, also greatly eased the problem of unwanted rotor-test stand coupling.

2. The test procedures and data analyis techniques, which were originally developed for hover, worked very well in forward flight. The use of multiblade coordinate data for the

damping measurements generally gave better results than did analysis of single blade signals. No problems peculiar to rotor stability testing in forward flight were encountered during the test.

3. The hover data obtained are consistent with previous experimental and theoretical results for hingeless rotors without kinematic couplings.

4. The most prominent feature of the forward flight data is an abrupt increase in damping with advance ratio at high speed, high shaft-angle conditions, and zero collective pitch. This behavior begins at lower advance ratios for more forward shaft angles, and seems related to high negative coning.

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TABLE 1.–ROTOR PROPERTIES

Property	Rotor I	Rotor II
Number of blades	3	3
Airfoil section	NACA 23012	NACA 23012
Hover tip Mach number at 1000 rpm	0.25	0.25
Hover tip Reynolds number at 1000 rpm	240,000	240,000
Rotor radius, in.	31.92	31.92
Blade chord, in.	1.65	1.65
Radial location of the center of the flexures, in.	3.55	3.55
Radial location of the blade center of mass, in.	11.1	11.1
Mass outboard of the flexure center, slugs	0.0130	0.0130
Flap and lead-lag inertia about flexure center, slug-in^2	1.80	1.80
Torsional inertia, slug-in^2	0.00294	0.00294
Flexure assembly flap stiffness, in-lb/radian	66.0	66.0
Flexure assembly lead-lag stiffness, in-lb/radian	281	281
Flexure assembly torsional stiffness, in-lb/radian	215	228
Nonrotating flap frequency, Hz	3.09	3.21
Nonrotating lead-lag frequency, Hz	6.98	7.24
Nonrotating torsion frequency, Hz	149	[a]
Nonrotating flap damping, 1/sec	-0.15	-0.09
Nonrotating lead-lag damping, 1/sec	-0.09	-0.09

[a] Not measured.

TABLE 2.–LEAD-LAG FLEXURE PROPERTIES

Blade station, in.	Mass, slug/in	Torsional inertia, slug-in^2/in	Flapping stiffness, lb-in^2	Lead-lag stiffness, lb-in^2	Torsional stiffness, lb-in^2
2.431	0.013 118	0.003 127	5 087 300	5 087 300	4 000 000
2.581	.013 118	.003 127	5 087 300	5 087 300	4 000 000
2.581	.003 568	.000 593	1 845 300	84 202	25 700
2.601	.002 492	.000 405	1 288 600	28 670	25 700
2.621	.002 202	.000 356	1 138 500	19 773	25 700
2.641	.002 117	.000 342	1 094 700	17 578	25 700
2.730	.002 117	.000 342	1 094 700	17 578	25 700
2.762	.001 799	.000 340	1 091 000	14 938	25 700
2.840	.000 765	.000 175	563 600	6 350	25 700
2.918	.000 584	.000 146	471 900	4 850	25 700
2.996	.000 765	.000 175	563 600	6 350	25 700
3.074	.001 700	.000 340	1 091 000	14 938	25 700
3.105	.002 117	.000 342	1 094 700	17 578	25 700
3.255	.002 117	.000 342	1 094 700	17 578	25 700
3.255	.002 117	.000 342	1 094 700	17 578	1 272
3.280	.000 903	.000 144	467 000	1 366	1 272
3.304	.000 550	.000 088	284 600	309	1 272
3.329	.000 448	.000 071	231 400	166	1 272
3.777	.000 448	.000 071	231 400	166	1 272
3.802	.000 550	.000 088	284 600	309	1 272
3.826	.000 903	.000 144	467 000	1 366	1 272
3.851	.002 117	.000 342	1 094 700	17 578	1 272
3.851	.002 117	.000 342	1 094 700	17 578	25 700
3.901	.002 117	.000 342	1 094 700	17 578	25 700
3.901	.002 566	.000 386	1 222 000	32 260	25 700
4.051	.002 566	.000 386	1 222 000	32 260	25 700
4.051	.002 117	.000 342	1 094 700	17 578	25 700
4.101	.002 117	.000 342	1 094 700	17 578	25 700

TABLE 3.–SIDE BEAM ASSEMBLY PROPERTIES

Blade station, in.	Mass, slug/in	Torsional inertia, slug-in^2/in	Flapping stiffness, lb-in^2	Lead-lag stiffness, lb-in^2	Torsional stiffness, lb-in^2
2.633	0.001 650	0.000 237	465 200	296 400	8 277
2.683	.001 650	.000 237	465 200	296 400	8 277
2.683	.001 905	.000 286	537 000	383 000	8 277
2.833	.001 905	.000 286	537 000	383 000	8 277
2.833	.001 650	.000 237	465 200	296 400	8 277
2.883	.001 650	.000 237	465 200	296 400	8 277
2.883	.001 274	.000 171	359 000	191 350	8 277
2.983	.001 274	.000 171	359 000	191 350	8 277
3.061	.000 601	.000 104	244 300	90 300	8 277
3.139	.000 497	.000 092	221 400	74 670	8 277
3.217	.000 601	.000 104	244 300	90 300	8 277
3.295	.001 274	.000 171	359 000	191 350	8 277
3.439	.001 274	.000 171	359 000	191 350	8 277
3.517	.000 601	.000 104	244 300	90 300	8 277
3.595	.000 497	.000 092	221 400	74 670	8 277
3.673	.000 601	.000 104	244 300	90 300	8 277
3.751	.001 274	.000 171	359 000	191 350	8 277
3.851	.001 274	.000 171	359 000	191 350	8 277
3.851	.001 915	.000 236	539 900	221 300	8 277
3.901	.001 915	.000 236	539 900	221 300	8 277
3.901	.001 661	.000 212	468 100	213 050	8 277
4.051	.001 661	.000 212	468 100	213 050	8 277
4.051	.001 915	.000 236	539 900	221 300	8 277
4.101	.001 915	.000 236	539 900	221 300	8 277

TABLE 4.–FLAP FLEXURE PROPERTIES

Blade station, in.	Mass, slug/in	Torsional inertia, slug-in^2/in	Flapping stiffness, lb-in^2	Lead-lag stiffness, lb-in^2	Torsional stiffness, lb-in^2
2.633	0.008 584	0.003 526	2 445 000	9 026 000	591 000
2.683	.008 584	.003 526	2 445 000	9 026 000	591 000
2.683	.008 135	.003 439	2 317 000	8 871 000	591 000
2.833	.008 135	.003 439	2 317 000	8 871 000	591 000
2.833	.008 584	.003 526	2 445 000	9 026 000	591 000
2.883	.008 584	.003 526	2 445 000	9 026 000	591 000
2.883	.001 382	.000 450	10 200	1 452 900	342
2.905	.000 558	.000 181	671	586 600	342
2.927	.000 340	.000 110	151	357 100	342
2.949	.000 276	.000 089	81.6	290 600	342
4.157	.000 276	.000 089	81.6	290 600	342
4.179	.000 340	.000 110	151	357 100	342
4.201	.000 558	.000 181	671	586 600	342
4.223	.001 382	.000 450	10 200	1 452 900	342
4.223	.007 515	.002 775	1 889 000	7 139 800	3 548 000
4.243	.007 515	.002 775	1 889 000	7 139 800	3 548 000
4.273	.008 054	.002 870	2 042 000	7 295 000	3 669 000
4.303	.011 406	.003 394	3 399 600	7 641 000	4 339 000
4.423	.011 406	.003 394	3 399 600	7 641 000	4 339 000

TABLE 5.–BLADE AND ROOT SOCKET PROPERTIES

Blade station, in.	Mass, slug/in	Torsional inertia, slug-in^2/in	Flapping stiffness, lb-in^2	Lead-lag stiffness, lb-in^2	Torsional stiffness, lb-in^2
4.423	0.006 894	0.001 708	1 770 000	3 660 000	2 180 000
4.484	.006 832	.001 708	1 770 000	3 660 000	2 180 000
4.484	.007 174	.001 708	1 770 000	3 660 000	2 180 000
4.613	.007 174	.001 708	1 770 000	3 660 000	2 180 000
4.613	.001 643	.000 077	124 000	124 000	95 900
5.078	.001 584	.000 076	124 000	124 000	95 900
5.260	.005 932	.001 224	124 000	124 000	95 900
5.410	.005 932	.001 224	124 000	124 000	95 900
5.410	.000 755	.000 023	45 900	45 900	23 800
5.469	.000 904	.000 027	53 800	53 800	28 800
5.469	.003 696	.000 457	53 800	53 800	28 800
5.529	.003 665	.000 481	99 100	99 100	61 600
5.529	.004 814	.000 916	99 100	99 100	61 600
5.659	.004 969	.000 922	101 000	101 000	59 600
5.659	.001 388	.000 053	101 000	101 000	59 600
5.764	.001 460	.000 052	102 000	102 000	56 800
5.764	.001 031	.000 021	52 600	52 600	18 700
5.924	.000 237	.000 022	2 280	61 700	1 200
7.924	.000 235	.000 027	2 280	61 700	1 200
31.92	.000 235	.000 027	2 280	61 700	1 200

TABLE 6.—REGRESSING LEAD-LAG MODE DATA IN HOVER, CONFIGURATION WITHOUT STRUCTURAL FLAP-LAG COUPLING

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82239001	0.0	49.57	0.00	6.201	-0.153
I	82242041	0.0	50.98	0.00	6.174	-0.154
II	83222012	0.0	50.82	-0.01	6.443	-0.082
II	83222013	0.0	50.82	-0.01	6.451	-0.077
I	82239003	0.0	100.66	0.00	5.377	-0.157
I	82242044	0.0	99.73	0.00	5.387	-0.152
I	82260007	0.0	100.78	0.00	5.377	-0.150
II	83222014	0.0	101.87	-0.01	5.627	-0.095
II	83222015	0.0	100.36	-0.01	5.654	-0.092
I	82239005	0.0	149.41	0.00	4.609	-0.160
I	82242046	0.0	150.59	0.00	4.588	-0.162
I	82239007	0.0	200.04	0.00	3.830	-0.175
I	82242048	0.0	200.39	0.00	3.822	-0.166
I	82260009	0.0	199.34	0.00	3.842	-0.160
II	83222016	0.0	200.84	-0.01	4.059	-0.117
II	83222017	0.0	200.84	-0.01	4.088	-0.114
I	82239009	0.0	250.66	0.00	3.068	-0.189
I	82242050	0.0	250.43	0.00	3.070	-0.175
I	82259056	0.0	275.16	0.00	2.709	-0.221
I	82259062	0.0	275.27	0.00	2.705	-0.189
I	82259063	0.0	274.92	0.00	2.709	-0.175
I	82259064	0.0	274.80	0.00	2.709	-0.177
I	82259058	0.0	290.27	0.00	2.482	-0.173
I	82259068	0.0	290.04	0.00	2.486	-0.168
I	82259069	0.0	289.80	0.00	2.490	-0.163
I	82239011	0.0	300.47	0.00	2.334	-0.180
I	82242008	0.0	301.05	0.00	2.330	-0.197
I	82242052	0.0	300.23	0.00	2.332	-0.179
I	82246001	0.0	301.17	0.00	2.318	-0.177
I	82260011	0.0	299.88	0.00	2.340	-0.179
II	83222018	0.0	300.05	-0.04	2.512	-0.136
II	83222019	0.0	300.86	-0.01	2.512	-0.135
I	82259060	0.0	315.00	0.00	2.121	-0.203
I	82259072	0.0	315.23	0.00	2.119	-0.176
I	82259073	0.0	316.05	0.00	2.109	-0.176
I	82242010	0.0	350.16	0.00	1.623	-0.185
I	82242054	0.0	350.39	0.00	1.607	-0.176
I	82246003	0.0	379.69	0.00	1.193	-0.201
I	82246011	0.0	380.04	0.00	1.170	-0.171
I	82242012	0.0	400.31	0.00	0.912	-0.179
I	82242056	0.0	399.38	0.00	0.914	-0.159
I	82260013	0.0	399.61	0.00	0.918	-0.155
II	83222020	0.0	400.29	-0.04	1.166	-0.144
II	83222021	0.0	400.99	-0.01	1.156	-0.140
I	82242060	0.0	499.45	0.00	0.441	-0.157
I	82260015	0.0	500.98	0.00	0.463	-0.153

TABLE 6.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82260032	0.0	500.74	-21.00	0.475	-0.169
I	82242018	0.0	549.96	0.00	1.115	-0.151
I	82242062	0.0	549.96	0.00	1.123	-0.148
I	82246005	0.0	565.66	0.00	1.326	-0.144
I	82246009	0.0	564.84	0.00	1.314	-0.143
I	82242020	0.0	600.59	0.00	1.775	-0.142
I	82242064	0.0	599.06	0.00	1.762	-0.147
I	82246007	0.0	600.35	0.00	1.756	-0.150
I	82260017	0.0	600.00	0.00	1.771	-0.151
II	83222024	0.0	599.28	-0.01	1.524	-0.135
II	83222025	0.0	600.21	-0.02	1.532	-0.128
II	83222030	0.0	601.02	0.03	1.545	-0.129
II	83222031	0.0	600.21	0.04	1.533	-0.128
I	82260030	0.0	600.82	-21.00	1.783	-0.149
I	82242022	0.0	649.80	0.00	2.406	-0.144
I	82242066	0.0	648.52	0.00	2.396	-0.147
I	82242024	0.0	699.26	0.00	3.031	-0.155
I	82242068	0.0	699.96	0.00	3.045	-0.156
I	82260019	0.0	699.61	0.00	3.039	-0.155
II	83222026	0.0	700.57	-0.01	2.818	-0.137
II	83222027	0.0	701.15	-0.03	2.823	-0.138
II	83222032	0.0	700.46	0.04	2.818	-0.138
II	83222033	0.0	699.30	0.03	2.802	-0.134
I	82260029	0.0	701.25	-21.00	3.061	-0.160
I	82242026	0.0	750.35	0.00	3.664	-0.165
I	82242070	0.0	750.35	0.00	3.668	-0.160
II	83222034	0.0	750.93	0.04	3.448	-0.141
II	83222035	0.0	750.46	0.04	3.440	-0.141
II	83222036	0.0	751.16	0.04	3.446	-0.134
II	83222037	0.0	751.62	0.02	3.456	-0.142
II	83222046	0.0	750.70	0.05	3.444	-0.140
II	83222047	0.0	750.35	0.05	3.440	-0.141
II	83223000	0.0	750.00	0.00	3.432	-0.140
II	83223001	0.0	750.00	0.00	3.429	-0.142
II	83223039	0.0	749.54	0.07	3.427	-0.142
II	83223040	0.0	749.42	0.06	3.425	-0.143
II	83223061	0.0	749.54	0.03	3.429	-0.140
II	83223062	0.0	747.91	0.03	3.409	-0.141
II	83223071	0.0	748.49	-0.14	3.417	-0.144
II	83223072	0.0	749.07	-0.14	3.423	-0.141
II	83224000	0.0	750.70	-0.06	3.440	-0.143
II	83224001	0.0	749.77	-0.05	3.427	-0.142
II	83228000	0.0	749.07	-0.01	3.427	-0.143
II	83228001	0.0	749.88	-0.01	3.436	-0.142
II	83229000	0.0	750.58	0.07	3.440	-0.142
II	83229001	0.0	750.12	0.07	3.434	-0.141

TABLE 6.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82260027	0.0	751.52	-21.00	3.684	-0.161
I	82242028	0.0	801.21	0.00	4.285	-0.170
I	82243007	0.0	800.63	0.00	4.281	-0.168
I	82260021	0.0	799.80	0.00	4.273	-0.161
II	83222038	0.0	799.20	0.02	4.040	-0.145
II	83222039	0.0	799.54	0.03	4.044	-0.143
I	82242031	0.0	849.61	0.00	4.871	-0.172
I	82242033	0.0	851.02	0.00	4.891	-0.171
I	82243009	0.0	850.43	0.00	4.879	-0.174
I	82242035	0.0	900.47	0.00	5.480	-0.173
I	82243011	0.0	900.94	0.00	5.482	-0.172
I	82250021	0.0	900.00	0.00	5.480	-0.177
I	82260023	0.0	900.47	0.00	5.480	-0.169
II	83222040	0.0	900.72	0.03	5.264	-0.154
II	83222041	0.0	900.60	0.03	5.260	-0.151
I	82242037	0.0	949.92	0.00	6.059	-0.185
I	82243013	0.0	949.45	0.00	6.051	-0.185
I	82250023	0.0	950.16	0.00	6.070	-0.180
I	82242039	0.0	999.61	0.00	6.639	-0.186
I	82243015	0.0	999.49	0.00	6.637	-0.190
I	82250025	0.0	1000.66	0.00	6.658	-0.184
I	82260025	0.0	999.84	0.00	6.643	-0.193
I	82263001	0.0	1000.43	0.00	6.646	-0.197
II	83222028	0.0	1000.39	-0.02	6.436	-0.163
II	83222029	0.0	999.23	-0.02	6.420	-0.156
II	83222042	0.0	999.81	0.03	6.428	-0.160
II	83222043	0.0	999.23	0.03	6.422	-0.162
II	83222044	0.0	999.34	0.03	6.420	-0.161
II	83222045	0.0	1000.62	0.03	6.440	-0.161
II	83223116	0.0	999.23	0.02	6.422	-0.161
II	83223117	0.0	1000.39	0.02	6.436	-0.162
II	83223118	0.0	1000.04	0.02	6.430	-0.160
II	83223119	0.0	999.23	0.03	6.420	-0.157
II	83224002	0.0	1000.62	-0.07	6.436	-0.165
II	83224003	0.0	999.92	-0.07	6.428	-0.163
II	83224030	0.0	1000.04	-0.01	6.432	-0.162
II	83224031	0.0	998.41	-0.01	6.411	-0.161
II	83224060	0.0	999.23	0.03	6.422	-0.163
II	83224061	0.0	999.69	0.03	6.430	-0.161
II	83224092	0.0	998.18	0.06	6.411	-0.159
II	83228002	0.0	1000.15	0.00	6.436	-0.158
II	83228003	0.0	999.34	0.00	6.424	-0.158
II	83228004	0.0	999.11	-0.01	6.422	-0.159
II	83229002	0.0	999.46	0.07	6.422	-0.163
II	83229003	0.0	1000.15	0.07	6.432	-0.163
I	82250027	0.0	1049.18	0.00	7.217	-0.191

TABLE 6.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82250029	0.0	1098.75	0.00	7.781	-0.198
I	82237013	3.0	201.09	0.00	3.805	-0.194
I	82237015	3.0	250.20	0.00	3.064	-0.177
II	83229046	3.0	748.14	0.03	3.411	-0.236
II	83229047	3.0	748.96	0.04	3.419	-0.235
II	83229048	3.0	748.72	0.03	3.421	-0.234
II	83229049	3.0	749.88	0.03	3.432	-0.232
II	83229050	3.0	748.96	0.03	3.425	-0.233
II	83229056	3.0	749.77	0.06	3.434	-0.233
II	83229057	3.0	747.91	0.06	3.409	-0.236
II	83236001	3.0	750.35	0.03	3.431	-0.222
II	83236002	3.0	750.00	0.03	3.427	-0.230
II	83236003	3.0	749.88	0.03	3.425	-0.224
II	83236004	3.0	751.04	0.03	3.442	-0.227
II	83236103	3.0	749.19	0.03	3.425	-0.232
II	83236104	3.0	749.77	0.03	3.432	-0.228
II	83237070	3.0	751.62	0.00	3.452	-0.235
II	83237071	3.0	751.28	0.00	3.446	-0.232
II	83237073	3.0	750.70	0.01	3.440	-0.232
II	83237074	3.0	749.77	0.02	3.429	-0.227
II	83237078	3.0	751.86	-0.10	3.458	-0.236
II	83229051	3.0	998.99	0.03	6.420	-0.285
II	83229052	3.0	998.99	0.04	6.418	-0.286
II	83229053	3.0	998.99	0.04	6.418	-0.291
II	83229054	3.0	999.23	0.04	6.422	-0.290
II	83229055	3.0	1001.08	0.04	6.441	-0.295
II	83229058	3.0	999.46	0.03	6.424	-0.294
II	83229059	3.0	999.81	0.04	6.430	-0.291
II	83236005	3.0	999.46	0.03	6.411	-0.261
II	83236006	3.0	1000.15	0.03	6.424	-0.290
II	83236007	3.0	1000.97	0.03	6.434	-0.283
II	83236008	3.0	1000.85	0.03	6.434	-0.279
II	83236009	3.0	1000.73	0.03	6.430	-0.288
II	83236042	3.0	1000.39	0.06	6.432	-0.281
II	83236072	3.0	999.57	0.02	6.422	-0.290
II	83236073	3.0	999.69	0.00	6.426	-0.282
I	82243025	4.0	50.51	0.00	6.168	-0.140
I	82244007	4.0	49.69	0.00	6.188	-0.133
I	82243027	4.0	100.43	0.00	5.365	-0.158
I	82244009	4.0	100.20	0.00	5.375	-0.161
I	82243029	4.0	149.65	0.00	4.594	-0.184
I	82244011	4.0	150.82	0.00	4.580	-0.190
I	82243031	4.0	200.16	0.00	3.813	-0.205
I	82244013	4.0	200.51	0.00	3.811	-0.204
I	82243033	4.0	249.84	0.00	3.059	-0.184
I	82244015	4.0	250.43	0.00	3.055	-0.186

TABLE 6.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82259037	4.0	275.16	0.00	2.689	-0.190
I	82259043	4.0	275.04	0.00	2.691	-0.181
I	82259039	4.0	289.69	0.00	2.473	-0.164
I	82259045	4.0	289.92	0.00	2.471	-0.180
I	82259046	4.0	289.57	0.00	2.479	-0.166
I	82243035	4.0	300.23	0.00	2.316	-0.173
I	82244017	4.0	300.23	0.00	2.318	-0.174
I	82259041	4.0	314.77	0.00	2.111	-0.177
I	82259048	4.0	315.59	0.00	2.104	-0.169
I	82243037	4.0	349.92	0.00	1.602	-0.147
I	82244019	4.0	349.22	0.00	1.615	-0.153
I	82244021	4.0	380.16	0.00	1.176	-0.129
I	82243039	4.0	399.26	0.00	0.908	-0.134
I	82244023	4.0	399.61	0.00	0.908	-0.136
I	82243043	4.0	500.39	0.00	0.457	-0.219
I	82244025	4.0	500.51	0.00	0.467	-0.216
I	82243045	4.0	549.61	0.00	1.119	-0.247
I	82243047	4.0	601.41	0.00	1.791	-0.240
I	82244027	4.0	599.18	0.00	1.764	-0.249
I	82243049	4.0	701.25	0.00	3.064	-0.287
I	82244029	4.0	699.84	0.00	3.045	-0.271
I	82243052	4.0	800.51	0.00	4.289	-0.311
I	82244031	4.0	799.92	0.00	4.277	-0.303
I	82243054	4.0	899.88	0.00	5.479	-0.337
I	82244033	4.0	899.88	0.00	5.467	-0.342
I	82243056	4.0	1000.08	0.00	6.639	-0.382
I	82244035	4.0	999.73	0.00	6.648	-0.370
I	82258013	6.0	50.51	0.00	6.160	-0.154
I	82258048	6.0	48.75	0.00	6.193	-0.127
I	82258015	6.0	100.55	0.00	5.355	-0.154
I	82258050	6.0	100.20	0.00	5.361	-0.181
I	82258017	6.0	200.39	0.00	3.799	-0.187
I	82258052	6.0	199.92	0.00	3.805	-0.196
I	82258019	6.0	250.78	0.00	3.039	-0.188
I	82258054	6.0	250.08	0.00	3.047	-0.191
I	82259001	6.0	274.92	0.00	2.682	-0.185
I	82259007	6.0	275.63	0.00	2.672	-0.186
I	82259003	6.0	290.16	0.00	2.455	-0.175
I	82259009	6.0	290.39	0.00	2.453	-0.173
I	82258021	6.0	300.59	0.00	2.305	-0.177
I	82258056	6.0	300.00	0.00	2.311	-0.183
I	82259005	6.0	314.77	0.00	2.100	-0.175
I	82259011	6.0	314.77	0.00	2.100	-0.165
I	82258024	6.0	350.51	0.00	1.586	-0.134
I	82258058	6.0	350.27	0.00	1.588	-0.133
I	82258026	6.0	399.26	0.00	0.906	-0.123

TABLE 6.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82258060	6.0	400.55	0.00	0.893	-0.149
I	82258028	6.0	500.39	0.00	0.479	-0.466
I	82258062	6.0	500.16	0.00	0.451	-0.234
I	82258030	6.0	600.35	0.00	1.779	-0.293
I	82258044	6.0	600.23	0.00	1.783	-0.344
I	82258045	6.0	600.23	0.00	1.777	-0.358
I	82258064	6.0	600.00	0.00	1.777	-0.292
I	82258032	6.0	699.49	0.00	3.039	-0.409
I	82258043	6.0	700.66	0.00	3.055	-0.418
I	82258066	6.0	699.96	0.00	3.045	-0.381
I	82258034	6.0	749.18	0.00	3.658	-0.401
I	82258042	6.0	751.41	0.00	3.689	-0.405
I	82258068	6.0	750.35	0.00	3.676	-0.418
II	83242000	6.0	750.46	0.00	3.429	-0.437
II	83242001	6.0	750.70	0.00	3.434	-0.394
II	83242002	6.0	749.65	0.03	3.436	-0.456
II	83242003	6.0	749.88	0.03	3.427	-0.352
II	83242004	6.0	751.28	0.03	3.454	-0.367
II	83242005	6.0	749.65	0.03	3.419	-0.448
II	83242006	6.0	749.88	0.03	3.432	-0.465
II	83242007	6.0	749.88	0.03	3.432	-0.439
II	83242013	6.0	748.84	0.07	3.417	-0.413
II	83242014	6.0	749.65	-19.96	3.432	-0.421
II	83242015	6.0	748.96	-19.95	3.423	-0.427
II	83242016	6.0	749.54	-19.95	3.431	-0.431
II	83242022	6.0	749.42	-19.93	3.431	-0.423
II	83242023	6.0	750.23	-19.92	3.438	-0.423
II	83243000	6.0	750.58	-19.99	3.438	-0.427
II	83243001	6.0	750.23	-19.98	3.434	-0.439
II	83243002	6.0	749.54	-19.98	3.425	-0.431
I	82258036	6.0	801.33	0.00	4.295	-0.463
I	82258070	6.0	800.04	0.00	4.283	-0.430
I	82258038	6.0	899.18	0.00	5.475	-0.507
I	82258072	6.0	899.88	0.00	5.475	-0.486
I	82258040	6.0	999.96	0.00	6.660	-0.599
I	82258074	6.0	1000.08	0.00	6.660	-0.558
II	83242008	6.0	999.81	0.03	6.412	-0.494
II	83242009	6.0	1000.04	0.03	6.440	-0.520
II	83242010	6.0	999.23	0.00	6.424	-0.544
II	83242011	6.0	998.76	-0.04	6.418	-0.548
II	83242017	6.0	998.41	-19.95	6.416	-0.560
II	83242018	6.0	997.83	-19.95	6.412	-0.566
II	83242019	6.0	1000.62	-19.96	6.447	-0.583
II	83242020	6.0	999.81	-19.96	6.434	-0.579
II	83242021	6.0	998.88	-19.96	6.422	-0.577
I	82244037	8.0	50.86	0.00	6.141	-0.154

TABLE 6.—CONCLUDED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82245015	8.0	49.80	0.00	6.164	-0.156
I	82244039	8.0	100.20	0.00	5.338	-0.183
I	82245017	8.0	100.08	0.00	5.350	-0.200
I	82244041	8.0	151.29	0.00	4.549	-0.181
I	82244043	8.0	199.69	0.00	3.789	-0.227
I	82245021	8.0	200.63	0.00	3.781	-0.222
I	82259019	8.0	275.39	0.00	2.658	-0.204
I	82259025	8.0	275.27	0.00	2.660	-0.196
I	82259021	8.0	291.33	0.00	2.422	-0.188
I	82259027	8.0	290.98	0.00	2.426	-0.186
I	82244045	8.0	299.30	0.00	2.301	-0.186
I	82245023	8.0	300.12	0.00	2.295	-0.189
I	82259023	8.0	315.47	0.00	2.074	-0.163
I	82259029	8.0	315.00	0.00	2.080	-0.160
I	82244047	8.0	379.69	0.00	1.170	-0.125
I	82245025	8.0	379.57	0.00	1.176	-0.105
I	82245048	8.0	379.92	0.00	1.164	-0.118
I	82245027	8.0	399.73	0.00	0.898	-0.135
I	82245013	8.0	564.73	0.00	1.307	-0.359
I	82245046	8.0	565.43	0.00	1.334	-0.421
I	82244053	8.0	599.06	0.00	1.770	-0.403
I	82244055	8.0	700.08	0.00	3.057	-0.502
I	82245034	8.0	699.73	0.00	3.037	-0.570
I	82244057	8.0	799.57	0.00	4.289	-0.557
I	82245007	8.0	800.39	0.00	4.295	-0.660
I	82245036	8.0	800.74	0.00	4.291	-0.727
I	82245038	8.0	800.16	0.00	4.291	-0.736
I	82245040	8.0	801.56	0.00	4.307	-0.698
I	82245009	8.0	900.35	0.00	5.467	-0.764
I	82245042	8.0	900.59	0.00	5.498	-0.655
I	82245011	8.0	1000.08	0.00	6.672	-0.863
I	82245044	8.0	999.49	0.00	6.639	-0.767

TABLE 7.—REGRESSING LEAD-LAG MODE DATA IN HOVER, CONFIGURATION WITH STRUCTURAL FLAP-LAG COUPLING

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82239001	0.0	49.57	0.00	6.201	-0.153
I	82242041	0.0	50.98	0.00	6.174	-0.154
II	83222012	0.0	50.82	-0.01	6.443	-0.082
II	83222013	0.0	50.82	-0.01	6.451	-0.077
I	82239003	0.0	100.66	0.00	5.377	-0.157
I	82242044	0.0	99.73	0.00	5.387	-0.152
I	82260007	0.0	100.78	0.00	5.377	-0.150
II	83222014	0.0	101.87	-0.01	5.627	-0.095
II	83222015	0.0	100.36	-0.01	5.654	-0.092
I	82239005	0.0	149.41	0.00	4.609	-0.160
I	82242046	0.0	150.59	0.00	4.588	-0.162
I	82239007	0.0	200.04	0.00	3.830	-0.175
I	82242048	0.0	200.39	0.00	3.822	-0.166
I	82260009	0.0	199.34	0.00	3.842	-0.160
II	83222016	0.0	200.84	-0.01	4.059	-0.117
II	83222017	0.0	200.84	-0.01	4.088	-0.114
I	82239009	0.0	250.66	0.00	3.068	-0.189
I	82242050	0.0	250.43	0.00	3.070	-0.175
I	82259056	0.0	275.16	0.00	2.709	-0.221
I	82259062	0.0	275.27	0.00	2.705	-0.189
I	82259063	0.0	274.92	0.00	2.709	-0.175
I	82259064	0.0	274.80	0.00	2.709	-0.177
I	82259058	0.0	290.27	0.00	2.482	-0.173
I	82259068	0.0	290.04	0.00	2.486	-0.168
I	82259069	0.0	289.80	0.00	2.490	-0.163
I	82239011	0.0	300.47	0.00	2.334	-0.180
I	82242008	0.0	301.05	0.00	2.330	-0.197
I	82242052	0.0	300.23	0.00	2.332	-0.179
I	82246001	0.0	301.17	0.00	2.318	-0.177
I	82260011	0.0	299.88	0.00	2.340	-0.179
II	83222018	0.0	300.05	-0.04	2.512	-0.136
II	83222019	0.0	300.86	-0.01	2.512	-0.135
I	82259060	0.0	315.00	0.00	2.121	-0.203
I	82259072	0.0	315.23	0.00	2.119	-0.176
I	82259073	0.0	316.05	0.00	2.109	-0.176
I	82242010	0.0	350.16	0.00	1.623	-0.185
I	82242054	0.0	350.39	0.00	1.607	-0.176
I	82246003	0.0	379.69	0.00	1.193	-0.201
I	82246011	0.0	380.04	0.00	1.170	-0.171
I	82242012	0.0	400.31	0.00	0.912	-0.179
I	82242056	0.0	399.38	0.00	0.914	-0.159
I	82260013	0.0	399.61	0.00	0.918	-0.155
II	83222020	0.0	400.29	-0.04	1.166	-0.144
II	83222021	0.0	400.99	-0.01	1.156	-0.140
I	82242060	0.0	499.45	0.00	0.441	-0.157
I	82260015	0.0	500.98	0.00	0.463	-0.153

TABLE 7.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82260032	0.0	500.74	-21.00	0.475	-0.169
I	82242018	0.0	549.96	0.00	1.115	-0.151
I	82242062	0.0	549.96	0.00	1.123	-0.148
I	82246005	0.0	565.66	0.00	1.326	-0.144
I	82246009	0.0	564.84	0.00	1.314	-0.143
I	82242020	0.0	600.59	0.00	1.775	-0.142
I	82242064	0.0	599.06	0.00	1.762	-0.147
I	82246007	0.0	600.35	0.00	1.756	-0.150
I	82260017	0.0	600.00	0.00	1.771	-0.151
II	83222024	0.0	599.28	-0.01	1.524	-0.135
II	83222025	0.0	600.21	-0.02	1.532	-0.128
II	83222030	0.0	601.02	0.03	1.545	-0.129
II	83222031	0.0	600.21	0.04	1.533	-0.128
I	82260030	0.0	600.82	-21.00	1.783	-0.149
I	82242022	0.0	649.80	0.00	2.406	-0.144
I	82242066	0.0	648.52	0.00	2.398	-0.147
I	82242024	0.0	699.26	0.00	3.031	-0.155
I	82242068	0.0	699.96	0.00	3.045	-0.156
I	82260019	0.0	699.61	0.00	3.039	-0.155
II	83222026	0.0	700.57	-0.01	2.818	-0.137
II	83222027	0.0	701.15	-0.03	2.823	-0.138
II	83222032	0.0	700.46	0.04	2.818	-0.138
II	83222033	0.0	699.30	0.03	2.802	-0.134
I	82260029	0.0	701.25	-21.00	3.061	-0.160
I	82242026	0.0	750.35	0.00	3.664	-0.165
I	82242070	0.0	750.35	0.00	3.668	-0.160
II	83222034	0.0	750.93	0.04	3.448	-0.141
II	83222035	0.0	750.46	0.04	3.440	-0.141
II	83222036	0.0	751.16	0.04	3.446	-0.134
II	83222037	0.0	751.62	0.02	3.456	-0.142
II	83222046	0.0	750.70	0.05	3.444	-0.140
II	83222047	0.0	750.35	0.05	3.440	-0.141
II	83223000	0.0	750.00	0.00	3.432	-0.140
II	83223001	0.0	750.00	0.00	3.429	-0.142
II	83223039	0.0	749.54	0.07	3.427	-0.142
II	83223040	0.0	749.42	0.06	3.425	-0.143
II	83223061	0.0	749.54	0.03	3.429	-0.140
II	83223062	0.0	747.91	0.03	3.409	-0.141
II	83223071	0.0	748.49	-0.14	3.417	-0.144
II	83223072	0.0	749.07	-0.14	3.423	-0.141
II	83224000	0.0	750.70	-0.06	3.440	-0.143
II	83224001	0.0	749.77	-0.05	3.427	-0.142
II	83228000	0.0	749.07	-0.01	3.427	-0.143
II	83228001	0.0	749.88	-0.01	3.436	-0.142
II	83229000	0.0	750.58	0.07	3.440	-0.142
II	83229001	0.0	750.12	0.07	3.434	-0.141

TABLE 7.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82260027	0.0	751.52	-21.00	3.684	-0.161
I	82242028	0.0	801.21	0.00	4.285	-0.170
I	82243007	0.0	800.63	0.00	4.281	-0.168
I	82260021	0.0	799.80	0.00	4.273	-0.161
II	83222038	0.0	799.20	0.02	4.040	-0.145
II	83222039	0.0	799.54	0.03	4.044	-0.143
I	82242031	0.0	849.61	0.00	4.871	-0.172
I	82242033	0.0	851.02	0.00	4.891	-0.171
I	82243009	0.0	850.43	0.00	4.879	-0.174
I	82242035	0.0	900.47	0.00	5.480	-0.173
I	82243011	0.0	900.94	0.00	5.482	-0.172
I	82250021	0.0	900.00	0.00	5.480	-0.177
I	82260023	0.0	900.47	0.00	5.480	-0.169
II	83222040	0.0	900.72	0.03	5.264	-0.154
II	83222041	0.0	900.60	0.03	5.260	-0.151
I	82242037	0.0	949.92	0.00	6.059	-0.185
I	82243013	0.0	949.45	0.00	6.051	-0.185
I	82250023	0.0	950.16	0.00	6.070	-0.180
I	82242039	0.0	999.61	0.00	6.639	-0.186
I	82243015	0.0	999.49	0.00	6.637	-0.190
I	82250025	0.0	1000.66	0.00	6.658	-0.184
I	82260025	0.0	999.84	0.00	6.643	-0.193
I	82263001	0.0	1000.43	0.00	6.646	-0.197
II	83222028	0.0	1000.39	-0.02	6.436	-0.163
II	83222029	0.0	999.23	-0.02	6.420	-0.156
II	83222042	0.0	999.81	0.03	6.428	-0.160
II	83222043	0.0	999.23	0.03	6.422	-0.162
II	83222044	0.0	999.34	0.03	6.420	-0.161
II	83222045	0.0	1000.62	0.03	6.440	-0.161
II	83223116	0.0	999.23	0.02	6.422	-0.161
II	83223117	0.0	1000.39	0.02	6.436	-0.162
II	83223118	0.0	1000.04	0.02	6.430	-0.160
II	83223119	0.0	999.23	0.03	6.420	-0.157
II	83224002	0.0	1000.62	-0.07	6.436	-0.165
II	83224003	0.0	999.92	-0.07	6.428	-0.163
II	83224030	0.0	1000.04	-0.01	6.432	-0.162
II	83224031	0.0	998.41	-0.01	6.411	-0.161
II	83224060	0.0	999.23	0.03	6.422	-0.163
II	83224061	0.0	999.69	0.03	6.430	-0.161
II	83224092	0.0	998.18	0.06	6.411	-0.159
II	83228002	0.0	1000.15	0.00	6.436	-0.158
II	83228003	0.0	999.34	0.00	6.424	-0.158
II	83228004	0.0	999.11	-0.01	6.422	-0.159
II	83229002	0.0	999.46	0.07	6.422	-0.163
II	83229003	0.0	1000.15	0.07	6.432	-0.163
I	82250027	0.0	1049.18	0.00	7.217	-0.191

TABLE 7.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82250029	0.0	1098.75	0.00	7.781	-0.198
II	83244000	3.0	50.47	0.07	6.457	-0.072
II	83244001	3.0	48.96	0.07	6.478	-0.075
II	83244002	3.0	50.01	0.07	6.459	-0.077
II	83244005	3.0	100.48	0.07	5.645	-0.098
II	83244006	3.0	99.78	0.07	5.658	-0.100
II	83244007	3.0	200.38	0.07	4.088	-0.119
II	83244008	3.0	200.15	0.07	4.092	-0.116
II	83244009	3.0	300.51	0.07	2.595	-0.129
II	83244010	3.0	300.39	0.07	2.597	-0.133
II	83244011	3.0	400.64	0.07	1.170	-0.175
II	83244012	3.0	400.64	0.07	1.168	-0.172
II	83244015	3.0	599.98	0.11	1.535	-0.254
II	83244016	3.0	599.98	0.11	1.532	-0.226
II	83244017	3.0	700.80	0.00	2.825	-0.243
II	83244018	3.0	700.92	0.00	2.827	-0.243
II	83244019	3.0	749.42	0.00	3.431	-0.251
II	83244020	3.0	749.54	0.00	3.432	-0.249
II	83244021	3.0	749.54	0.00	3.432	-0.248
II	83244022	3.0	749.19	0.00	3.427	-0.258
II	83255000	3.0	750.23	0.03	3.438	-0.245
II	83255001	3.0	749.42	0.03	3.431	-0.242
II	83255002	3.0	749.77	0.03	3.434	-0.243
II	83255033	3.0	750.12	-0.05	3.442	-0.243
II	83255034	3.0	749.65	-0.05	3.436	-0.246
II	83256000	3.0	749.88	0.04	3.434	-0.245
II	83256001	3.0	749.54	0.04	3.431	-0.241
II	83256032	3.0	750.35	0.03	3.444	-0.243
II	83256033	3.0	750.23	0.03	3.442	-0.241
II	83256070	3.0	750.23	0.02	3.440	-0.248
II	83256071	3.0	750.00	0.02	3.440	-0.241
II	83256072	3.0	749.54	0.02	3.434	-0.234
II	83258000	3.0	750.23	0.03	3.440	-0.240
II	83258001	3.0	751.04	0.01	3.450	-0.250
II	83258030	3.0	750.70	0.03	3.448	-0.244
II	83258031	3.0	749.42	0.03	3.432	-0.249
II	83258037	3.0	749.42	-0.07	3.432	-0.244
II	83258038	3.0	748.96	-0.07	3.427	-0.245
II	83244023	3.0	750.46	-19.92	3.444	-0.245
II	83244024	3.0	750.58	-19.92	3.446	-0.252
II	83255003	3.0	750.00	-19.97	3.438	-0.240
II	83255004	3.0	750.35	-19.98	3.440	-0.241
II	83256002	3.0	748.96	-19.98	3.423	-0.240
II	83256003	3.0	750.35	-19.97	3.440	-0.238
II	83258002	3.0	750.00	-20.00	3.436	-0.238
II	83258003	3.0	749.54	-19.99	3.429	-0.239

TABLE 7.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83258032	3.0	750.58	-19.93	3.448	-0.243
II	83258033	3.0	749.19	-19.94	3.429	-0.244
II	83258039	3.0	749.42	-19.98	3.432	-0.244
II	83258040	3.0	749.88	-19.98	3.436	-0.250
II	83244025	3.0	799.78	0.03	4.051	-0.256
II	83244026	3.0	799.66	0.03	4.047	-0.256
II	83244027	3.0	899.44	0.03	5.252	-0.270
II	83244028	3.0	899.56	0.03	5.254	-0.271
II	83244029	3.0	999.34	0.03	6.428	-0.294
II	83244030	3.0	999.57	0.03	6.430	-0.290
II	83244031	3.0	1000.15	0.03	6.436	-0.288
II	83244032	3.0	999.92	0.03	6.434	-0.288
II	83244036	3.0	999.46	0.07	6.430	-0.292
II	83244037	3.0	999.46	0.07	6.428	-0.291
II	83245000	3.0	1000.85	0.03	6.438	-0.293
II	83245001	3.0	1000.27	0.03	6.434	-0.293
II	83249000	3.0	1001.32	-0.09	6.443	-0.291
II	83249001	3.0	999.69	-0.09	6.426	-0.304
II	83250000	3.0	1002.24	-0.03	6.457	-0.286
II	83250001	3.0	1001.20	0.00	6.443	-0.293
II	83250004	3.0	999.57	0.00	6.428	-0.285
II	83250005	3.0	998.53	-0.07	6.416	-0.292
II	83251000	3.0	1001.55	0.00	6.445	-0.288
II	83251001	3.0	1000.04	0.00	6.428	-0.286
II	83251022	3.0	999.81	0.07	6.428	-0.285
II	83251023	3.0	999.11	0.07	6.420	-0.283
II	83251028	3.0	1000.27	0.03	6.436	-0.280
II	83251029	3.0	1000.97	0.03	6.443	-0.286
II	83252000	3.0	1000.73	0.07	6.436	-0.282
II	83252001	3.0	1000.73	0.08	6.436	-0.283
II	83252054	3.0	1000.00	0.00	6.430	-0.285
II	83252055	3.0	1000.00	0.00	6.416	-0.286
II	83244033	3.0	999.92	-19.92	6.434	-0.294
II	83244034	3.0	998.99	-19.91	6.422	-0.296
II	83244035	3.0	999.23	-19.91	6.426	-0.299
II	83249002	3.0	1000.50	-19.94	6.434	-0.284
II	83249003	3.0	1000.97	-19.94	6.441	-0.291
II	83250002	3.0	1000.50	-20.00	6.434	-0.282
II	83250003	3.0	999.34	-19.99	6.422	-0.289
II	83250006	3.0	1000.04	-19.98	6.434	-0.290
II	83250007	3.0	999.46	-19.98	6.426	-0.287
II	83251002	3.0	998.76	-19.96	6.412	-0.282
II	83251003	3.0	999.46	-19.96	6.420	-0.286
II	83251024	3.0	999.11	-19.92	6.418	-0.285
II	83251025	3.0	999.57	-19.92	6.424	-0.291
II	83251030	3.0	999.23	-19.94	6.424	-0.286

TABLE 7.—CONCLUDED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83251031	3.0	999.69	-19.93	6.430	-0.291
II	83252002	3.0	1001.32	-20.00	6.441	-0.285
II	83252003	3.0	999.23	-20.00	6.418	-0.288
II	83259022	6.0	750.58	0.07	3.450	-0.512
II	83259023	6.0	750.70	0.07	3.461	-0.556
II	83259024	6.0	750.12	0.07	3.452	-0.570
II	83259021	6.0	751.39	-19.95	3.471	-0.560
II	83259025	6.0	749.65	-19.97	3.448	-0.586
II	83259026	6.0	749.65	-19.96	3.450	-0.589
II	83259027	6.0	750.12	-19.96	3.454	-0.589
II	83259081	6.0	999.46	-0.01	6.449	-0.701
II	83259082	6.0	999.92	-0.01	6.451	-0.690
II	83259083	6.0	999.92	-20.00	6.457	-0.678
II	83259084	6.0	1000.04	-20.00	6.457	-0.723
II	83259085	6.0	998.65	-20.00	6.440	-0.723

TABLE 8.—REGRESSING LEAD-LAG MODE DATA IN FORWARD FLIGHT, CONFIGURATION WITHOUT STRUCTURAL FLAP-LAG COUPLING, 750 RPM

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83222048	0.0	749.54	0.095	-0.07	3.431	-0.150
II	83222049	0.0	750.46	0.093	-0.07	3.442	-0.150
II	83222050	0.0	751.39	0.093	-1.99	3.454	-0.147
II	83222051	0.0	749.42	0.093	-1.99	3.429	-0.145
II	83222052	0.0	749.19	0.093	-4.02	3.427	-0.144
II	83222053	0.0	749.88	0.093	-4.02	3.434	-0.145
II	83222054	0.0	750.70	0.092	-6.03	3.444	-0.144
II	83222055	0.0	750.35	0.092	-6.03	3.440	-0.142
II	83222056	0.0	750.46	0.093	-8.03	3.440	-0.139
II	83222057	0.0	750.93	0.093	-8.03	3.446	-0.138
II	83222058	0.0	749.88	0.093	-10.07	3.434	-0.137
II	83222059	0.0	750.12	0.096	-10.07	3.436	-0.138
II	83222060	0.0	750.70	0.095	-12.04	3.444	-0.138
II	83222061	0.0	750.58	0.097	-12.04	3.442	-0.137
II	83222062	0.0	750.35	0.096	-12.04	3.438	-0.133
II	83222063	0.0	751.39	0.096	-12.05	3.452	-0.136
II	83222064	0.0	751.74	0.096	-14.04	3.458	-0.140
II	83222065	0.0	750.93	0.098	-14.04	3.448	-0.141
II	83222066	0.0	751.97	0.099	-15.96	3.461	-0.148
II	83222067	0.0	750.46	0.098	-15.96	3.442	-0.146
II	83222068	0.0	751.04	0.096	-15.96	3.450	-0.148
II	83222069	0.0	751.39	0.098	-18.02	3.456	-0.163
II	83222070	0.0	750.93	0.095	-18.02	3.452	-0.162
II	83222071	0.0	750.81	0.096	-19.64	3.450	-0.173
II	83222072	0.0	750.81	0.094	-19.64	3.450	-0.170
II	83222073	0.0	748.96	0.149	-0.09	3.425	-0.152
II	83222074	0.0	749.19	0.150	-0.09	3.427	-0.150
II	83223002	0.0	750.00	0.150	0.00	3.434	-0.153
II	83223003	0.0	750.00	0.150	0.00	3.434	-0.156
II	83223004	0.0	750.00	0.150	0.00	3.425	-0.152
II	83222075	0.0	750.12	0.146	-2.00	3.438	-0.148
II	83222076	0.0	750.00	0.148	-2.00	3.436	-0.147
II	83222077	0.0	749.42	0.150	-4.04	3.429	-0.145
II	83222078	0.0	749.54	0.147	-4.04	3.431	-0.144
II	83222079	0.0	749.65	0.149	-6.01	3.431	-0.141
II	83222080	0.0	749.54	0.149	-6.02	3.429	-0.141
II	83222081	0.0	750.12	0.149	-7.93	3.436	-0.138
II	83222082	0.0	750.35	0.146	-7.92	3.440	-0.138
II	83222083	0.0	749.65	0.149	-10.00	3.432	-0.149
II	83222084	0.0	750.00	0.150	-10.00	3.436	-0.146
II	83222085	0.0	750.46	0.149	-12.01	3.446	-0.172
II	83222086	0.0	750.46	0.146	-12.01	3.446	-0.166
II	83222087	0.0	750.12	0.148	-12.01	3.440	-0.169
II	83223005	0.0	750.00	0.150	-12.00	3.434	-0.176
II	83223006	0.0	750.00	0.150	-12.00	3.434	-0.171
II	83223007	0.0	750.00	0.150	-14.00	3.446	-0.190

TABLE 8.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83223008	0.0	750.00	0.150	-14.00	3.448	-0.184
II	83223009	0.0	750.00	0.150	-14.00	3.448	-0.194
II	83223011	0.0	750.00	0.150	-16.00	3.435	-0.201
II	83223012	0.0	750.00	0.150	-16.00	3.431	-0.196
II	83223013	0.0	750.00	0.150	-16.00	3.436	-0.198
II	83223014	0.0	750.00	0.150	-18.00	3.440	-0.195
II	83223015	0.0	750.00	0.150	-18.00	3.450	-0.202
II	83223016	0.0	750.00	0.150	-20.00	3.432	-0.198
II	83223017	0.0	750.00	0.150	-20.00	3.432	-0.198
II	83223018	0.0	750.00	0.200	0.00	3.438	-0.159
II	83223019	0.0	750.00	0.200	0.00	3.438	-0.160
II	83223020	0.0	750.00	0.200	-2.00	3.432	-0.148
II	83223021	0.0	750.00	0.200	-2.00	3.434	-0.154
II	83223022	0.0	750.00	0.200	-4.00	3.440	-0.148
II	83223023	0.0	750.00	0.200	-4.00	3.440	-0.144
II	83223024	0.0	750.00	0.200	-6.00	3.444	-0.149
II	83223025	0.0	750.00	0.200	-6.00	3.433	-0.140
II	83223026	0.0	750.00	0.200	-8.00	3.431	-0.160
II	83223027	0.0	750.00	0.200	-8.00	3.436	-0.164
II	83223028	0.0	750.00	0.200	-10.00	3.442	-0.182
II	83223029	0.0	750.00	0.200	-10.00	3.438	-0.191
II	83223030	0.0	750.00	0.200	-10.00	3.438	-0.188
II	83223031	0.0	750.00	0.200	-12.00	3.442	-0.193
II	83223032	0.0	750.00	0.200	-12.00	3.431	-0.198
II	83223033	0.0	750.00	0.200	-14.00	3.452	-0.192
II	83223034	0.0	750.00	0.200	-14.00	3.413	-0.189
II	83223035	0.0	750.00	0.200	-16.00	3.440	-0.201
II	83223036	0.0	750.00	0.200	-16.00	3.444	-0.205
II	83223037	0.0	750.00	0.200	-18.00	3.448	-0.201
II	83223038	0.0	750.00	0.200	-18.00	3.450	-0.204
II	83223041	0.0	748.61	0.249	0.00	3.417	-0.159
II	83223042	0.0	751.16	0.248	-0.01	3.452	-0.160
II	83223043	0.0	750.46	0.245	-2.04	3.440	-0.155
II	83223044	0.0	750.12	0.248	-2.04	3.436	-0.161
II	83223045	0.0	749.07	0.248	-3.99	3.427	-0.151
II	83223046	0.0	749.30	0.250	-3.99	3.427	-0.151
II	83223047	0.0	748.84	0.251	-6.03	3.423	-0.161
II	83223048	0.0	748.38	0.250	-6.03	3.419	-0.159
II	83223049	0.0	748.38	0.251	-8.07	3.419	-0.181
II	83223050	0.0	749.54	0.250	-8.07	3.436	-0.169
II	83223051	0.0	748.61	0.253	-8.07	3.423	-0.184
II	83223052	0.0	750.93	0.250	-8.03	3.454	-0.179
II	83223053	0.0	751.28	0.251	-10.03	3.454	-0.196
II	83223054	0.0	750.93	0.251	-10.03	3.454	-0.184
II	83223055	0.0	750.81	0.251	-10.03	3.448	-0.196
II	83223056	0.0	751.28	0.249	-11.97	3.460	-0.198

TABLE 8.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83223057	0.0	751.16	0.252	-11.96	3.454	-0.199
II	83223058	0.0	750.58	0.245	-14.07	3.452	-0.189
II	83223059	0.0	749.88	0.248	-14.07	3.442	-0.176
II	83223060	0.0	749.30	0.247	-14.04	3.438	-0.167
II	83223063	0.0	748.96	0.294	0.02	3.427	-0.169
II	83223064	0.0	749.19	0.295	0.01	3.427	-0.159
II	83223066	0.0	749.77	0.296	-0.06	3.436	-0.165
II	83223067	0.0	747.68	0.300	-2.02	3.411	-0.156
II	83223068	0.0	750.00	0.301	-2.02	3.438	-0.153
II	83223069	0.0	750.00	0.296	-2.02	3.440	-0.158
II	83223086	0.0	750.46	0.296	-2.02	3.444	-0.156
II	83223070	0.0	750.00	0.300	-3.99	3.440	-0.137
II	83223073	0.0	748.38	0.297	-4.06	3.419	-0.147
II	83223074	0.0	750.81	0.302	-4.02	3.450	-0.150
II	83223075	0.0	750.93	0.298	-4.02	3.452	-0.151
II	83223076	0.0	749.65	0.299	-6.00	3.438	-0.164
II	83223077	0.0	751.04	0.297	-5.99	3.454	-0.169
II	83223078	0.0	750.23	0.295	-5.99	3.444	-0.167
II	83223079	0.0	748.49	0.299	-7.99	3.427	-0.185
II	83223080	0.0	749.54	0.302	-7.99	3.440	-0.166
II	83223081	0.0	748.61	0.299	-7.99	3.425	-0.173
II	83223082	0.0	749.88	0.299	-7.99	3.442	-0.180
II	83223083	0.0	750.35	0.302	-10.03	3.452	-0.187
II	83223084	0.0	749.19	0.303	-10.03	3.432	-0.187
II	83223085	0.0	749.77	0.298	-10.03	3.442	-0.193
II	83223087	0.0	750.23	0.347	0.02	3.444	-0.165
II	83223088	0.0	750.46	0.346	0.02	3.446	-0.173
II	83223089	0.0	750.58	0.349	-0.01	3.442	-0.188
II	83223090	0.0	750.12	0.348	-1.99	3.442	-0.159
II	83223091	0.0	749.88	0.350	-1.99	3.438	-0.158
II	83223092	0.0	749.77	0.351	-4.00	3.438	-0.154
II	83223093	0.0	750.12	0.347	-3.99	3.442	-0.152
II	83223094	0.0	749.42	0.348	-6.03	3.434	-0.173
II	83223095	0.0	749.65	0.348	-6.03	3.436	-0.165
II	83223096	0.0	750.23	0.350	-6.03	3.446	-0.170
II	83223097	0.0	749.88	0.354	-8.00	3.440	-0.168
II	83223098	0.0	749.19	0.351	-8.02	3.434	-0.158
II	83223099	0.0	749.19	0.348	-8.04	3.434	-0.192
II	83223100	0.0	750.00	0.397	-0.05	3.442	-0.166
II	83223101	0.0	750.00	0.395	-0.01	3.442	-0.170
II	83223102	0.0	750.00	0.400	-2.02	3.440	-0.161
II	83223103	0.0	750.23	0.401	-2.02	3.444	-0.161
II	83223104	0.0	750.23	0.400	-3.96	3.446	-0.149
II	83223105	0.0	748.61	0.402	-3.99	3.425	-0.162
II	83223106	0.0	750.81	0.399	-3.99	3.450	-0.151
II	83223107	0.0	750.93	0.399	-3.99	3.452	-0.153

TABLE 8.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83223108	0.0	751.51	0.399	-6.03	3.460	-0.158
II	83223109	0.0	751.51	0.400	-6.03	3.460	-0.162
II	83223110	0.0	749.54	0.447	-0.09	3.436	-0.179
II	83223111	0.0	750.35	0.447	-0.10	3.446	-0.177
II	83223112	0.0	749.19	0.451	-1.99	3.431	-0.177
II	83223113	0.0	749.30	0.451	-1.99	3.431	-0.173
II	83223114	0.0	749.19	0.450	-3.99	3.434	-0.157
II	83223115	0.0	750.12	0.449	-3.99	3.442	-0.157
II	83236105	3.0	748.96	0.091	0.06	3.425	-0.235
II	83236106	3.0	748.96	0.090	0.06	3.425	-0.235
II	83236107	3.0	750.93	0.093	-1.99	3.450	-0.237
II	83236108	3.0	750.81	0.093	-1.98	3.450	-0.239
II	83236109	3.0	752.09	0.093	-4.02	3.465	-0.237
II	83236110	3.0	750.00	0.093	-4.02	3.438	-0.236
II	83236111	3.0	751.28	0.094	-6.00	3.454	-0.231
II	83236112	3.0	748.84	0.094	-6.02	3.425	-0.236
II	83236113	3.0	749.54	0.094	-7.99	3.432	-0.244
II	83236114	3.0	749.07	0.094	-7.99	3.427	-0.233
II	83236115	3.0	748.61	0.094	-7.99	3.419	-0.245
II	83236116	3.0	748.96	0.095	-7.99	3.425	-0.242
II	83236117	3.0	750.00	0.094	-10.03	3.436	-0.242
II	83236118	3.0	749.30	0.093	-10.03	3.429	-0.242
II	83236119	3.0	748.72	0.094	-11.97	3.421	-0.239
II	83236120	3.0	750.58	0.096	-11.96	3.444	-0.241
II	83236121	3.0	749.42	0.096	-13.98	3.429	-0.236
II	83236122	3.0	749.19	0.096	-13.98	3.427	-0.237
II	83236123	3.0	750.23	0.095	-16.01	3.438	-0.229
II	83236124	3.0	751.04	0.095	-16.01	3.448	-0.243
II	83236125	3.0	749.19	0.095	-16.01	3.425	-0.234
II	83236126	3.0	748.61	0.095	-16.01	3.419	-0.229
II	83236127	3.0	748.84	0.095	-18.01	3.421	-0.220
II	83236128	3.0	750.46	0.096	-18.01	3.442	-0.228
II	83236129	3.0	750.12	0.097	-18.01	3.436	-0.229
II	83236130	3.0	750.23	0.096	-18.01	3.436	-0.229
II	83236133	3.0	750.46	0.095	-19.95	3.440	-0.231
II	83236134	3.0	750.46	0.095	-19.95	3.440	-0.222
II	83237002	3.0	749.65	0.144	-0.03	3.429	-0.260
II	83237003	3.0	750.70	0.143	-0.06	3.442	-0.254
II	83237004	3.0	749.77	0.145	-2.03	3.431	-0.249
II	83237005	3.0	750.35	0.145	-2.03	3.436	-0.252
II	83237006	3.0	750.58	0.145	-4.02	3.438	-0.249
II	83237007	3.0	748.96	0.144	-4.02	3.419	-0.245
II	83237008	3.0	751.28	0.144	-6.00	3.446	-0.250
II	83237009	3.0	748.84	0.147	-6.00	3.415	-0.251
II	83237010	3.0	749.54	0.144	-8.03	3.425	-0.245
II	83237011	3.0	750.81	0.146	-8.03	3.440	-0.243

TABLE 8.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83237012	3.0	749.54	0.146	-10.07	3.423	-0.245
II	83237013	3.0	749.07	0.146	-10.07	3.419	-0.238
II	83237014	3.0	749.77	0.145	-12.04	3.427	-0.236
II	83237015	3.0	750.35	0.145	-12.04	3.432	-0.235
II	83237016	3.0	749.77	0.144	-13.93	3.425	-0.233
II	83237017	3.0	750.23	0.145	-13.93	3.432	-0.233
II	83237018	3.0	751.16	0.145	-15.97	3.440	-0.228
II	83237019	3.0	749.42	0.148	-15.97	3.421	-0.230
II	83237020	3.0	748.84	0.148	-18.01	3.413	-0.223
II	83237021	3.0	750.00	0.147	-18.01	3.427	-0.221
II	83237022	3.0	750.35	0.149	-19.94	3.429	-0.217
II	83237023	3.0	749.65	0.145	-19.95	3.421	-0.214
II	83237024	3.0	750.12	0.192	-6.04	3.434	-0.250
II	83237025	3.0	749.88	0.195	-6.04	3.431	-0.255
II	83237026	3.0	749.19	0.197	-8.01	3.423	-0.245
II	83237027	3.0	750.58	0.197	-8.00	3.440	-0.243
II	83237028	3.0	750.12	0.196	-10.00	3.431	-0.240
II	83237029	3.0	750.46	0.197	-10.00	3.436	-0.240
II	83237030	3.0	750.58	0.196	-12.01	3.436	-0.232
II	83237031	3.0	750.12	0.195	-12.01	3.431	-0.236
II	83237032	3.0	749.65	0.195	-13.97	3.423	-0.218
II	83237033	3.0	749.42	0.197	-13.97	3.423	-0.227
II	83237034	3.0	750.00	0.194	-13.97	3.429	-0.230
II	83237035	3.0	749.30	0.196	-13.97	3.421	-0.229
II	83237036	3.0	750.93	0.195	-16.02	3.438	-0.226
II	83237037	3.0	749.42	0.198	-16.01	3.419	-0.218
II	83237038	3.0	750.00	0.197	-16.01	3.427	-0.220
II	83237039	3.0	750.00	0.195	-16.01	3.427	-0.223
II	83237040	3.0	749.54	0.196	-18.00	3.419	-0.216
II	83237041	3.0	749.65	0.197	-18.00	3.421	-0.215
II	83237042	3.0	750.81	0.196	-19.95	3.440	-0.207
II	83237043	3.0	751.16	0.196	-19.95	3.442	-0.218
II	83237044	3.0	749.42	0.199	-19.95	3.419	-0.206
II	83237045	3.0	750.35	0.198	-19.95	3.431	-0.217
II	83237046	3.0	749.65	0.248	-8.08	3.431	-0.237
II	83237047	3.0	750.23	0.244	-8.08	3.436	-0.245
II	83237048	3.0	749.30	0.247	-8.08	3.425	-0.241
II	83237049	3.0	749.42	0.248	-8.08	3.427	-0.244
II	83237050	3.0	749.30	0.247	-10.04	3.423	-0.229
II	83237051	3.0	749.42	0.245	-10.04	3.425	-0.241
II	83237052	3.0	749.77	0.246	-10.04	3.429	-0.240
II	83237053	3.0	750.35	0.244	-10.04	3.436	-0.226
II	83237054	3.0	749.54	0.247	-12.01	3.425	-0.231
II	83237055	3.0	750.35	0.249	-12.01	3.434	-0.227
II	83237056	3.0	750.58	0.248	-12.01	3.438	-0.224
II	83237057	3.0	750.12	0.250	-13.97	3.429	-0.215

TABLE 8.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83237058	3.0	749.19	0.251	-13.97	3.417	-0.205
II	83237059	3.0	749.54	0.249	-13.97	3.421	-0.220
II	83237060	3.0	749.88	0.244	-13.97	3.427	-0.218
II	83237061	3.0	750.23	0.247	-16.07	3.431	-0.207
II	83237062	3.0	749.54	0.248	-16.07	3.421	-0.213
II	83237063	3.0	750.00	0.250	-16.06	3.429	-0.191
II	83237064	3.0	748.96	0.243	-16.08	3.415	-0.201
II	83237065	3.0	751.16	0.247	-18.02	3.446	-0.195
II	83237066	3.0	749.42	0.250	-18.02	3.425	-0.210
II	83237067	3.0	749.42	0.249	-18.02	3.425	-0.210
II	83237068	3.0	749.65	0.251	-18.02	3.425	-0.206
II	83237069	3.0	748.72	0.245	-19.94	3.419	-0.196
II	83237070	3.0	748.61	0.245	-19.95	3.415	-0.211
II	83237071	3.0	748.84	0.241	-19.94	3.419	-0.198
II	83237072	3.0	749.07	0.246	-19.95	3.423	-0.200
II	83237075	3.0	748.84	0.296	-7.95	3.421	-0.235
II	83237076	3.0	748.72	0.298	-7.96	3.419	-0.257
II	83237077	3.0	749.77	0.293	-7.96	3.432	-0.227
II	83237079	3.0	748.84	0.295	-8.03	3.421	-0.240
II	83237080	3.0	747.91	0.295	-8.03	3.409	-0.236
II	83237081	3.0	748.84	0.301	-10.03	3.419	-0.232
II	83237082	3.0	748.72	0.304	-10.03	3.417	-0.238
II	83237083	3.0	750.00	0.299	-10.03	3.432	-0.224
II	83237084	3.0	749.42	0.303	-12.04	3.425	-0.220
II	83237085	3.0	750.12	0.300	-12.04	3.432	-0.206
II	83237086	3.0	749.77	0.299	-12.04	3.427	-0.220
II	83237087	3.0	749.19	0.299	-12.04	3.421	-0.227
II	83237088	3.0	748.84	0.303	-13.97	3.417	-0.197
II	83237089	3.0	750.93	0.300	-13.96	3.444	-0.200
II	83237090	3.0	750.12	0.298	-13.97	3.434	-0.200
II	83237091	3.0	750.46	0.301	-16.04	3.442	-0.190
II	83237092	3.0	749.88	0.299	-16.04	3.436	-0.196
II	83237093	3.0	750.93	0.294	-16.04	3.450	-0.182
II	83237094	3.0	750.23	0.299	-16.04	3.440	-0.181
II	83237095	3.0	750.23	0.300	-17.98	3.440	-0.171
II	83237096	3.0	750.00	0.301	-17.98	3.440	-0.185
II	83237097	3.0	750.12	0.296	-17.98	3.440	-0.191
II	83237098	3.0	749.77	0.297	-17.98	3.434	-0.189
II	83237099	3.0	750.93	0.301	-19.94	3.452	-0.149
II	83237100	3.0	749.65	0.297	-19.95	3.438	-0.150
II	83237101	3.0	749.42	0.299	-19.95	3.436	-0.180
II	83237102	3.0	749.88	0.297	-19.95	3.442	-0.184
II	83237103	3.0	750.12	0.347	-8.08	3.438	-0.240
II	83237104	3.0	750.58	0.344	-8.08	3.444	-0.249
II	83237105	3.0	750.58	0.346	-8.04	3.444	-0.235
II	83237106	3.0	750.70	0.346	-10.01	3.442	-0.227

TABLE 8.—CONCLUDED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83237107	3.0	750.12	0.350	-10.00	3.436	-0.227
II	83237108	3.0	749.42	0.346	-10.00	3.425	-0.220
II	83237109	3.0	750.58	0.348	-12.04	3.440	-0.201
II	83237110	3.0	750.23	0.353	-12.04	3.436	-0.193
II	83237111	3.0	749.65	0.344	-12.04	3.429	-0.211
II	83237112	3.0	750.70	0.351	-14.08	3.448	-0.165
II	83237113	3.0	751.16	0.350	-14.08	3.452	-0.181
II	83237114	3.0	750.93	0.346	-14.08	3.448	-0.178
II	83237115	3.0	749.42	0.351	-14.07	3.429	-0.166
II	83237116	3.0	750.81	0.350	-16.04	3.452	-0.170
II	83237117	3.0	750.00	0.350	-16.04	3.442	-0.155
II	83237118	3.0	750.12	0.350	-16.04	3.442	-0.175
II	83237119	3.0	750.23	0.351	-18.01	3.448	-0.186
II	83237120	3.0	750.93	0.349	-18.01	3.456	-0.170
II	83237121	3.0	751.04	0.349	-18.01	3.460	-0.195
II	83237122	3.0	751.39	0.349	-18.01	3.461	-0.188
II	83243003	5.0	749.65	0.096	-11.99	3.429	-0.421
II	83243004	6.0	750.81	0.095	-12.00	3.444	-0.432
II	83243005	6.0	749.65	0.093	-14.00	3.429	-0.432
II	83243006	6.0	750.35	0.095	-14.03	3.438	-0.429
II	83243007	6.0	750.23	0.093	-15.97	3.436	-0.427
II	83243008	6.0	750.81	0.095	-15.97	3.444	-0.430
II	83243009	6.0	749.54	0.095	-17.97	3.427	-0.422
II	83243010	6.0	749.88	0.093	-17.97	3.434	-0.432
II	83243011	6.0	750.58	0.093	-20.00	3.438	-0.422
II	83243012	6.0	750.23	0.094	-20.00	3.436	-0.424
II	83243013	6.0	750.12	0.145	-15.97	3.436	-0.435
II	83243014	6.0	750.46	0.143	-15.97	3.440	-0.445
II	83243015	6.0	749.42	0.147	-18.01	3.427	-0.440
II	83243016	6.0	750.46	0.148	-18.02	3.438	-0.427
II	83243017	6.0	751.39	0.145	-20.00	3.450	-0.429
II	83243025	6.0	748.72	0.146	-20.00	3.417	-0.429
II	83243026	6.0	748.84	0.148	-20.00	3.417	-0.430
II	83243018	6.0	749.65	0.197	-16.01	3.429	-0.435
II	83243019	6.0	750.00	0.196	-16.01	3.434	-0.431
II	83243020	6.0	750.00	0.197	-16.01	3.434	-0.434
II	83243021	6.0	750.23	0.197	-18.05	3.432	-0.436
II	83243022	6.0	749.19	0.195	-18.05	3.423	-0.429
II	83243023	6.0	748.96	0.198	-20.00	3.417	-0.420
II	83243024	6.0	749.07	0.199	-20.00	3.419	-0.420

TABLE 9.—REGRESSING LEAD–LAG MODE DATA IN FORWARD FLIGHT, CONFIGURATION WITHOUT STRUCTURAL FLAP–LAG COUPLING, 1000 RPM

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83223120	0.0	999.69	0.044	0.02	6.428	-0.164
II	83223121	0.0	1000.62	0.042	0.02	6.440	-0.163
II	83223122	0.0	999.34	0.043	-1.97	6.426	-0.163
II	83223123	0.0	999.23	0.044	-1.97	6.422	-0.162
II	83223124	0.0	997.95	0.045	-4.02	6.409	-0.161
II	83223125	0.0	997.60	0.044	-4.04	6.405	-0.163
II	83223126	0.0	1000.39	0.044	-6.04	6.436	-0.160
II	83223127	0.0	1000.62	0.044	-6.04	6.438	-0.163
II	83223128	0.0	999.92	0.045	-8.03	6.432	-0.162
II	83223129	0.0	1000.15	0.044	-8.03	6.432	-0.160
II	83223130	0.0	1000.15	0.044	-10.00	6.432	-0.161
II	83223131	0.0	999.81	0.044	-10.00	6.428	-0.162
II	83223132	0.0	999.34	0.044	-11.97	6.422	-0.160
II	83223133	0.0	999.34	0.043	-11.97	6.422	-0.158
II	83223134	0.0	1000.04	0.043	-14.00	6.430	-0.157
II	83223135	0.0	999.92	0.043	-14.00	6.430	-0.158
II	83223136	0.0	999.92	0.043	-16.04	6.430	-0.157
II	83223137	0.0	999.46	0.043	-16.04	6.424	-0.158
II	83223138	0.0	998.41	0.043	-17.98	6.411	-0.155
II	83223139	0.0	999.81	0.043	-17.98	6.428	-0.158
II	83223140	0.0	1000.85	0.043	-19.64	6.441	-0.157
II	83223141	0.0	1000.15	0.043	-19.64	6.434	-0.157
II	83224004	0.0	1000.04	0.097	0.00	6.430	-0.168
II	83224005	0.0	999.11	0.096	0.00	6.416	-0.164
II	83224006	0.0	999.57	0.095	0.00	6.422	-0.167
II	83224029	0.0	999.34	0.095	-0.01	6.422	-0.169
II	83224007	0.0	999.92	0.096	-2.01	6.428	-0.169
II	83224008	0.0	998.65	0.097	-2.01	6.412	-0.167
II	83224009	0.0	998.88	0.097	-3.98	6.414	-0.166
II	83224010	0.0	999.23	0.097	-3.98	6.418	-0.168
II	83224011	0.0	1001.32	0.097	-5.98	6.443	-0.162
II	83224012	0.0	1000.27	0.097	-5.96	6.432	-0.168
II	83224013	0.0	998.99	0.098	-5.96	6.418	-0.166
II	83224014	0.0	1000.04	0.099	-7.99	6.428	-0.163
II	83224015	0.0	999.34	0.099	-7.99	6.420	-0.165
II	83224016	0.0	1000.85	0.099	-10.00	6.438	-0.164
II	83224017	0.0	1000.27	0.097	-10.00	6.430	-0.164
II	83224018	0.0	1000.97	0.097	-12.04	6.438	-0.168
II	83224019	0.0	1001.43	0.097	-12.04	6.443	-0.176
II	83224020	0.0	1001.55	0.097	-12.02	6.447	-0.172
II	83224021	0.0	999.46	0.097	-13.96	6.426	-0.186
II	83224022	0.0	999.69	0.097	-13.96	6.428	-0.184
II	83224023	0.0	998.88	0.097	-16.01	6.418	-0.200
II	83224024	0.0	998.53	0.097	-16.00	6.414	-0.199
II	83224025	0.0	1000.04	0.096	-17.97	6.432	-0.203
II	83224026	0.0	998.53	0.096	-17.97	6.414	-0.206

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83224027	0.0	999.57	0.096	-19.64	6.426	-0.204
II	83224028	0.0	999.11	0.095	-19.65	6.420	-0.204
I	82263003	0.0	1000.08	0.149	0.00	6.639	-0.194
I	82263005	0.0	1001.13	0.142	0.00	6.639	-0.179
I	82263017	0.0	999.38	0.149	0.00	6.639	-0.175
II	83224032	0.0	998.30	0.148	0.00	6.412	-0.170
II	83224033	0.0	1000.04	0.148	0.00	6.434	-0.174
II	83224058	0.0	1000.15	0.146	0.02	6.434	-0.163
II	83224059	0.0	999.57	0.152	0.01	6.428	-0.170
I	82263004	0.0	1000.31	0.149	-2.00	6.652	-0.180
I	82263006	0.0	1000.08	0.146	-2.00	6.652	-0.176
I	82263018	0.0	1000.08	0.148	-2.00	6.639	-0.174
II	83224034	0.0	1000.27	0.146	-2.02	6.436	-0.169
II	83224035	0.0	1000.39	0.150	-2.02	6.438	-0.169
I	82263007	0.0	1000.08	0.148	-4.00	6.639	-0.176
I	82263008	0.0	999.96	0.148	-4.00	6.639	-0.172
I	82263019	0.0	1000.08	0.149	-4.00	6.639	-0.173
II	83224036	0.0	999.34	0.150	-4.02	6.424	-0.165
II	83224037	0.0	999.57	0.147	-4.02	6.428	-0.166
I	82263009	0.0	999.96	0.148	-6.00	6.639	-0.176
I	82263020	0.0	999.61	0.148	-6.00	6.639	-0.168
I	82263021	0.0	1000.31	0.148	-6.00	6.639	-0.172
II	83224038	0.0	1000.97	0.150	-5.99	6.443	-0.162
II	83224039	0.0	1000.39	0.148	-5.99	6.438	-0.176
II	83224040	0.0	998.41	0.148	-5.99	6.414	-0.160
II	83224041	0.0	999.92	0.148	-6.00	6.432	-0.162
I	82263010	0.0	1000.43	0.149	-8.00	6.639	-0.177
I	82263022	0.0	999.84	0.147	-8.00	6.639	-0.175
II	83224042	0.0	999.46	0.148	-7.99	6.424	-0.173
II	83224043	0.0	999.46	0.148	-7.99	6.428	-0.170
I	82263011	0.0	999.84	0.149	-10.00	6.639	-0.198
I	82263023	0.0	999.96	0.148	-10.00	6.639	-0.190
II	83224044	0.0	1001.08	0.148	-10.03	6.447	-0.189
II	83224045	0.0	999.23	0.148	-10.03	6.426	-0.187
I	82263012	0.0	999.38	0.149	-12.00	6.639	-0.207
I	82263024	0.0	1000.31	0.148	-12.00	6.639	-0.202
II	83224046	0.0	1000.15	0.150	-12.07	6.438	-0.205
II	83224047	0.0	1000.27	0.149	-12.08	6.438	-0.193
II	83224048	0.0	1000.15	0.150	-12.08	6.436	-0.200
I	82263013	0.0	1000.78	0.148	-14.00	6.639	-0.212
I	82263025	0.0	1000.08	0.147	-14.00	6.654	-0.212
II	83224049	0.0	1000.15	0.149	-14.00	6.436	-0.207
II	83224050	0.0	999.81	0.149	-14.00	6.432	-0.208
I	82263014	0.0	999.26	0.147	-16.00	6.639	-0.212
I	82263026	0.0	999.96	0.147	-16.00	6.652	-0.210
II	83224051	0.0	1001.66	0.149	-16.02	6.453	-0.202

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83224052	0.0	1000.62	0.148	-16.03	6.440	-0.202
I	82263015	0.0	999.84	0.148	-18.00	6.639	-0.205
I	82263027	0.0	999.84	0.148	-18.00	6.648	-0.210
II	83224053	0.0	999.81	0.148	-18.00	6.432	-0.212
II	83224054	0.0	999.23	0.147	-17.99	6.424	-0.207
II	83224055	0.0	998.88	0.148	-17.99	6.420	-0.208
I	82263016	0.0	1000.08	0.148	-20.00	6.639	-0.207
I	82263028	0.0	1000.43	0.148	-20.00	6.658	-0.201
II	83224056	0.0	1001.20	0.147	-19.64	6.447	-0.209
II	83224057	0.0	1000.39	0.147	-19.64	6.438	-0.206
I	82263029	0.0	1000.55	0.202	0.00	6.658	-0.180
I	82264001	0.0	999.84	0.199	0.00	6.643	-0.186
I	82264002	0.0	1001.72	0.200	0.00	6.664	-0.179
II	83224062	0.0	998.18	0.199	0.02	6.412	-0.169
II	83224063	0.0	999.57	0.199	0.02	6.428	-0.178
II	83224064	0.0	999.92	0.197	0.02	6.434	-0.172
I	82263030	0.0	1001.25	0.200	-2.00	6.668	-0.179
I	82264003	0.0	1000.55	0.199	-2.00	6.650	-0.180
I	82264004	0.0	1001.13	0.198	-2.00	6.658	-0.186
II	83224065	0.0	998.99	0.201	-2.06	6.424	-0.169
II	83224066	0.0	999.46	0.198	-2.06	6.428	-0.167
I	82263031	0.0	1000.78	0.201	-4.00	6.660	-0.177
I	82264005	0.0	1000.90	0.201	-4.00	6.656	-0.185
I	82264007	0.0	1000.20	0.200	-4.00	6.646	-0.178
II	83224067	0.0	1001.43	0.199	-3.95	6.451	-0.164
II	83224068	0.0	998.99	0.199	-3.99	6.422	-0.162
I	82263032	0.0	999.96	0.201	-6.00	6.652	-0.178
I	82264008	0.0	999.49	0.200	-6.00	6.643	-0.190
I	82264009	0.0	1000.08	0.199	-6.00	6.646	-0.185
II	83224069	0.0	998.99	0.201	-5.99	6.422	-0.166
II	83224070	0.0	999.92	0.199	-5.99	6.432	-0.182
II	83224071	0.0	998.76	0.201	-5.99	6.420	-0.171
II	83224072	0.0	999.57	0.198	-5.99	6.432	-0.170
I	82263033	0.0	999.02	0.201	-8.00	6.639	-0.195
I	82264010	0.0	1000.78	0.199	-8.00	6.656	-0.205
I	82264011	0.0	1001.25	0.200	-8.00	6.662	-0.206
I	82264012	0.0	999.96	0.200	-8.00	6.648	-0.206
II	83224073	0.0	999.11	0.201	-7.99	6.428	-0.184
II	83224074	0.0	1000.62	0.199	-7.99	6.443	-0.192
II	83224075	0.0	999.69	0.199	-7.99	6.432	-0.182
II	83224076	0.0	999.34	0.196	-7.99	6.432	-0.194
I	82263034	0.0	1001.13	0.202	-10.00	6.666	-0.206
I	82264013	0.0	999.96	0.199	-10.00	6.646	-0.211
I	82264014	0.0	999.26	0.198	-10.00	6.641	-0.211
II	83224077	0.0	998.88	0.199	-10.03	6.424	-0.206
II	83224078	0.0	998.88	0.201	-10.03	6.424	-0.212

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83224079	0.0	999.11	0.199	-10.03	6.428	-0.196
I	82263035	0.0	1001.60	0.203	-12.00	6.674	-0.199
I	82264015	0.0	1000.20	0.198	-12.00	6.648	-0.213
I	82264016	0.0	1000.20	0.200	-12.00	6.648	-0.208
I	82264017	0.0	1001.60	0.199	-12.00	6.666	-0.206
II	83224080	0.0	999.34	0.197	-12.02	6.426	-0.200
II	83224081	0.0	998.53	0.201	-12.02	6.418	-0.202
II	83224082	0.0	999.57	0.201	-12.02	6.432	-0.211
II	83224083	0.0	999.11	0.200	-12.02	6.426	-0.209
I	82263036	0.0	1000.08	0.202	-14.00	6.652	-0.195
I	82264018	0.0	1000.43	0.199	-14.00	6.652	-0.200
I	82264019	0.0	1000.78	0.199	-14.00	6.656	-0.196
I	82264020	0.0	1000.55	0.198	-14.00	6.652	-0.199
II	83224084	0.0	998.99	0.199	-14.00	6.422	-0.199
II	83224085	0.0	998.07	0.197	-14.00	6.412	-0.195
II	83224086	0.0	1000.27	0.198	-14.00	6.440	-0.201
II	83224087	0.0	1000.15	0.199	-14.00	6.438	-0.188
I	82263037	0.0	999.49	0.202	-16.00	6.648	-0.194
I	82264021	0.0	999.96	0.200	-16.00	6.650	-0.205
I	82264022	0.0	1000.08	0.200	-16.00	6.652	-0.192
I	82264023	0.0	1000.43	0.199	-16.00	6.656	-0.201
II	83224088	0.0	999.46	0.199	-16.01	6.432	-0.179
II	83224089	0.0	999.81	0.197	-16.01	6.436	-0.189
II	83224090	0.0	999.57	0.199	-16.01	6.432	-0.199
II	83224091	0.0	999.92	0.200	-16.01	6.438	-0.187
I	82263038	0.0	1000.31	0.200	-18.00	6.666	-0.180
I	82264024	0.0	1001.84	0.197	-18.00	6.682	-0.182
I	82264025	0.0	1000.08	0.199	-18.00	6.658	-0.190
I	82264026	0.0	1001.13	0.200	-18.00	6.670	-0.177
I	82263039	0.0	999.61	0.202	-20.00	6.662	-0.180
I	82264027	0.0	999.73	0.200	-20.00	6.658	-0.172
I	82264028	0.0	1000.66	0.199	-20.00	6.672	-0.195
I	82264029	0.0	1000.43	0.197	-20.00	6.668	-0.197
I	82264030	0.0	1000.08	0.251	0.00	6.650	-0.185
I	82264031	0.0	999.61	0.250	0.00	6.645	-0.188
II	83224094	0.0	999.92	0.250	0.02	6.432	-0.175
II	83224095	0.0	1000.97	0.249	0.02	6.445	-0.181
II	83224096	0.0	1000.04	0.249	0.02	6.434	-0.177
I	82264032	0.0	999.96	0.250	-2.00	6.650	-0.187
I	82264033	0.0	999.84	0.251	-2.00	6.646	-0.180
II	83224097	0.0	1000.97	0.248	-2.06	6.445	-0.177
II	83224098	0.0	999.23	0.249	-2.06	6.426	-0.166
II	83224099	0.0	1000.97	0.249	-2.06	6.445	-0.172
I	82264034	0.0	1001.02	0.250	-4.00	6.660	-0.189
I	82264035	0.0	999.26	0.250	-4.00	6.641	-0.190
II	83224100	0.0	999.92	0.252	-3.99	6.434	-0.160

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83224079	0.0	999.11	0.199	-10.03	6.428	-0.196
I	82263035	0.0	1001.60	0.203	-12.00	6.674	-0.199
I	82264015	0.0	1000.20	0.198	-12.00	6.648	-0.213
I	82264016	0.0	1000.20	0.200	-12.00	6.648	-0.208
I	82264017	0.0	1001.60	0.199	-12.00	6.666	-0.206
II	83224080	0.0	999.34	0.197	-12.02	6.426	-0.200
II	83224081	0.0	998.53	0.201	-12.02	6.418	-0.202
II	83224082	0.0	999.57	0.201	-12.02	6.432	-0.211
II	83224083	0.0	999.11	0.200	-12.02	6.426	-0.209
I	82263036	0.0	1000.08	0.202	-14.00	6.652	-0.195
I	82264018	0.0	1000.43	0.199	-14.00	6.652	-0.200
I	82264019	0.0	1000.78	0.199	-14.00	6.656	-0.196
I	82264020	0.0	1000.55	0.198	-14.00	6.652	-0.199
II	83224084	0.0	998.99	0.199	-14.00	6.422	-0.199
II	83224085	0.0	998.07	0.197	-14.00	6.412	-0.195
II	83224086	0.0	1000.27	0.198	-14.00	6.440	-0.201
II	83224087	0.0	1000.15	0.199	-14.00	6.438	-0.188
I	82263037	0.0	999.49	0.202	-16.00	6.648	-0.194
I	82264021	0.0	999.96	0.200	-16.00	6.650	-0.205
I	82264022	0.0	1000.08	0.200	-16.00	6.652	-0.192
I	82264023	0.0	1000.43	0.199	-16.00	6.656	-0.201
II	83224088	0.0	999.46	0.199	-16.01	6.432	-0.179
II	83224089	0.0	999.81	0.197	-16.01	6.436	-0.189
II	83224090	0.0	999.57	0.199	-16.01	6.432	-0.199
II	83224091	0.0	999.92	0.200	-16.01	6.438	-0.187
I	82263038	0.0	1000.31	0.200	-18.00	6.666	-0.180
I	82264024	0.0	1001.84	0.197	-18.00	6.682	-0.182
I	82264025	0.0	1000.08	0.199	-18.00	6.658	-0.190
I	82264026	0.0	1001.13	0.200	-18.00	6.670	-0.177
I	82263039	0.0	999.61	0.202	-20.00	6.662	-0.180
I	82264027	0.0	999.73	0.200	-20.00	6.658	-0.172
I	82264028	0.0	1000.66	0.199	-20.00	6.672	-0.195
I	82264029	0.0	1000.43	0.197	-20.00	6.668	-0.197
I	82264030	0.0	1000.08	0.251	0.00	6.650	-0.185
I	82264031	0.0	999.61	0.250	0.00	6.645	-0.188
II	83224094	0.0	999.92	0.250	0.02	6.432	-0.175
II	83224095	0.0	1000.97	0.249	0.02	6.445	-0.181
II	83224096	0.0	1000.04	0.249	0.02	6.434	-0.177
I	82264032	0.0	999.96	0.250	-2.00	6.650	-0.187
I	82264033	0.0	999.84	0.251	-2.00	6.646	-0.180
II	83224097	0.0	1000.97	0.248	-2.06	6.445	-0.177
II	83224098	0.0	999.23	0.249	-2.06	6.426	-0.166
II	83224099	0.0	1000.97	0.249	-2.06	6.445	-0.172
I	82264034	0.0	1001.02	0.250	-4.00	6.660	-0.189
I	82264035	0.0	999.26	0.250	-4.00	6.641	-0.190
II	83224100	0.0	999.92	0.252	-3.99	6.434	-0.160

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83224101	0.0	999.34	0.250	-3.99	6.428	-0.165
II	83224102	0.0	999.57	0.251	-3.99	6.430	-0.171
II	83224103	0.0	1000.04	0.251	-3.99	6.434	-0.164
I	82264036	0.0	999.73	0.250	-6.00	6.648	-0.199
I	82264037	0.0	999.73	0.250	-6.00	6.648	-0.192
I	82264038	0.0	1000.90	0.250	-6.00	6.664	-0.196
II	83224104	0.0	1000.04	0.250	-5.92	6.436	-0.183
II	83224105	0.0	999.11	0.249	-5.92	6.424	-0.185
II	83224106	0.0	999.34	0.251	-5.92	6.428	-0.182
I	82264039	0.0	1000.90	0.250	-8.00	6.666	-0.200
I	82264040	0.0	1001.48	0.249	-8.00	6.672	-0.198
II	83224107	0.0	1000.04	0.251	-8.00	6.436	-0.207
II	83224108	0.0	999.34	0.248	-8.00	6.428	-0.200
II	83224109	0.0	998.65	0.248	-7.99	6.422	-0.202
I	82264041	0.0	1000.55	0.250	-10.00	6.639	-0.201
I	82264042	0.0	999.84	0.254	-10.00	6.639	-0.195
I	82264043	0.0	1000.90	0.252	-12.00	6.639	-0.195
I	82264044	0.0	999.84	0.252	-12.00	6.639	-0.195
I	82264045	0.0	998.32	0.252	-14.00	6.641	-0.182
I	82264046	0.0	999.96	0.252	-14.00	6.662	-0.184
I	82264047	0.0	1000.90	0.250	-16.00	6.639	-0.200
I	82264048	0.0	998.55	0.250	-16.00	6.639	-0.197
I	82264049	0.0	1000.20	0.252	-18.00	6.639	-0.224
I	82264050	0.0	999.38	0.253	-18.00	6.672	-0.231
I	82264051	0.0	1000.66	0.250	-20.00	6.639	-0.229
I	82264052	0.0	1000.90	0.250	-20.00	6.639	-0.216
I	82264053	0.0	999.73	0.301	0.00	6.639	-0.182
I	82264054	0.0	999.14	0.301	0.00	6.639	-0.183
II	83224110	0.0	999.81	0.297	0.02	6.432	-0.187
II	83224111	0.0	998.99	0.299	0.06	6.424	-0.173
II	83224112	0.0	999.46	0.299	0.06	6.426	-0.184
II	83224113	0.0	999.34	0.297	0.06	6.430	-0.180
II	83228005	0.0	1000.62	0.298	0.00	6.443	-0.163
II	83228006	0.0	1000.73	0.297	0.00	6.445	-0.202
II	83228007	0.0	1000.27	0.302	0.00	6.441	-0.176
II	83228008	0.0	999.69	0.298	-0.01	6.434	-0.181
II	83228009	0.0	998.76	0.302	-0.01	6.424	-0.184
II	83228010	0.0	999.46	0.301	-0.01	6.432	-0.195
II	83229004	0.0	1000.15	0.298	-0.04	6.432	-0.182
II	83229005	0.0	1001.20	0.300	-0.04	6.445	-0.176
I	82264055	0.0	999.96	0.300	-2.00	6.639	-0.184
I	82264056	0.0	1000.20	0.301	-2.00	6.639	-0.184
II	83224114	0.0	1000.04	0.301	-2.02	6.436	-0.175
II	83224115	0.0	999.81	0.299	-2.02	6.434	-0.177
II	83224116	0.0	1000.62	0.299	-2.02	6.441	-0.166
II	83224117	0.0	999.92	0.300	-2.02	6.434	-0.172

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83228011	0.0	997.95	0.300	-2.02	6.414	-0.178
II	83228012	0.0	999.34	0.302	-2.02	6.430	-0.171
II	83228013	0.0	999.23	0.299	-2.02	6.430	-0.177
II	83228014	0.0	1000.50	0.301	-2.02	6.445	-0.170
I	82264057	0.0	999.84	0.300	-4.00	6.639	-0.187
I	82264058	0.0	999.38	0.302	-4.00	6.639	-0.185
II	83228015	0.0	1000.50	0.300	-4.01	6.445	-0.163
II	83228016	0.0	999.92	0.299	-4.01	6.440	-0.171
II	83228017	0.0	999.46	0.297	-4.01	6.434	-0.170
II	83228018	0.0	999.46	0.297	-4.01	6.434	-0.160
I	82264059	0.0	1000.08	0.299	-6.00	6.639	-0.204
I	82264060	0.0	1000.20	0.298	-6.00	6.639	-0.201
II	83228019	0.0	998.53	0.298	-5.96	6.424	-0.185
II	83228020	0.0	998.88	0.300	-5.96	6.428	-0.196
II	83228021	0.0	998.99	0.298	-5.96	6.430	-0.190
II	83228022	0.0	998.41	0.300	-5.96	6.422	-0.199
II	83228023	0.0	1000.04	0.297	-5.96	6.440	-0.193
I	82264061	0.0	1000.08	0.299	-8.00	6.639	-0.196
I	82264062	0.0	1000.43	0.299	-8.00	6.639	-0.202
II	83228024	0.0	1000.73	0.300	-7.99	6.449	-0.203
II	83228025	0.0	1000.73	0.297	-7.99	6.445	-0.207
II	83228026	0.0	1001.43	0.299	-7.99	6.457	-0.202
II	83228027	0.0	1000.85	0.300	-7.99	6.451	-0.197
I	82264063	0.0	1001.13	0.299	-10.00	6.639	-0.185
I	82264064	0.0	1000.43	0.299	-10.00	6.639	-0.191
I	82264065	0.0	1001.37	0.300	-12.00	6.639	-0.189
I	82264066	0.0	1001.84	0.299	-12.00	6.639	-0.193
I	82264067	0.0	999.96	0.300	-14.00	6.639	-0.244
I	82264068	0.0	999.38	0.299	-14.00	6.639	-0.242
I	82264069	0.0	999.84	0.301	-16.00	6.684	-0.308
I	82264070	0.0	1000.43	0.299	-16.00	6.639	-0.277
I	82264071	0.0	1000.20	0.297	-16.00	6.639	-0.274
I	82264072	0.0	1001.13	0.299	-18.00	6.639	-0.293
I	82264073	0.0	1001.60	0.295	-18.00	6.639	-0.293
I	82264074	0.0	999.84	0.299	-20.00	6.639	-0.326
I	82264075	0.0	999.96	0.301	-20.00	6.639	-0.348
I	82264076	0.0	1000.08	0.350	0.00	6.639	-0.215
I	82264077	0.0	1000.43	0.348	0.00	6.639	-0.181
I	82264078	0.0	1001.48	0.350	0.00	6.639	-0.212
I	82264079	0.0	1000.08	0.353	0.00	6.639	-0.194
II	83229006	0.0	999.46	0.346	-0.01	6.424	-0.195
II	83229007	0.0	999.69	0.350	-0.01	6.428	-0.197
II	83229008	0.0	999.57	0.350	-0.02	6.426	-0.183
II	83229009	0.0	998.88	0.349	-0.02	6.418	-0.194
I	82264080	0.0	999.84	0.351	-2.00	6.639	-0.189
I	82264081	0.0	998.32	0.352	-2.00	6.635	-0.188

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83229010	0.0	999.23	0.350	-1.99	6.424	-0.187
II	83229011	0.0	999.23	0.351	-1.99	6.422	-0.183
II	83229012	0.0	1000.27	0.350	-1.99	6.434	-0.180
II	83229013	0.0	1000.04	0.349	-1.99	6.434	-0.184
I	82264082	0.0	998.67	0.351	-4.00	6.637	-0.185
I	82264083	0.0	1000.31	0.349	-4.00	6.639	-0.190
II	83229014	0.0	999.34	0.352	-4.02	6.424	-0.183
II	83229015	0.0	999.69	0.349	-4.03	6.430	-0.175
II	83229016	0.0	999.11	0.348	-4.03	6.422	-0.184
II	83229017	0.0	1001.90	0.347	-4.03	6.455	-0.186
I	82264084	0.0	1000.43	0.349	-6.00	6.639	-0.203
I	82264085	0.0	999.84	0.351	-6.00	6.639	-0.202
II	83229018	0.0	998.65	0.349	-5.98	6.416	-0.193
II	83229019	0.0	999.69	0.351	-5.98	6.424	-0.192
II	83229020	0.0	999.69	0.349	-5.98	6.428	-0.203
II	83229021	0.0	998.99	0.351	-5.98	6.422	-0.211
I	82264086	0.0	1000.43	0.351	-8.00	6.639	-0.209
I	82264087	0.0	1000.20	0.350	-8.00	6.639	-0.209
I	82264088	0.0	1000.55	0.351	-10.00	6.639	-0.225
I	82264089	0.0	1000.08	0.352	-10.00	6.639	-0.237
I	82265001	0.0	1000.90	0.349	-10.00	6.639	-0.219
I	82265002	0.0	1001.25	0.348	-10.00	6.639	-0.220
I	82265003	0.0	1000.08	0.349	-12.00	6.639	-0.325
I	82265004	0.0	999.84	0.350	-12.00	6.639	-0.327
I	82265005	0.0	999.49	0.350	-14.00	6.639	-0.375
I	82265006	0.0	1000.66	0.349	-14.00	6.686	-0.347
I	82265007	0.0	1000.55	0.351	-16.00	6.695	-0.398
I	82265008	0.0	1000.43	0.350	-16.00	6.691	-0.413
I	82265009	0.0	1000.20	0.350	-16.00	6.689	-0.363
I	82265010	0.0	1000.90	0.350	-16.00	6.701	-0.383
I	82265011	0.0	999.96	0.350	-18.00	6.695	-0.435
I	82265012	0.0	1000.20	0.350	-18.00	6.711	-0.440
I	82265013	0.0	1000.43	0.348	-20.00	6.721	-0.494
I	82265014	0.0	1002.30	0.348	-20.00	6.740	-0.436
I	82265015	0.0	1000.20	0.400	0.00	6.645	-0.195
I	82265016	0.0	999.73	0.399	0.00	6.639	-0.230
I	82265017	0.0	1000.55	0.400	0.00	6.652	-0.217
II	83229022	0.0	999.11	0.397	0.00	6.420	-0.204
II	83229023	0.0	999.46	0.396	0.00	6.424	-0.196
II	83229024	0.0	1000.85	0.397	0.00	6.441	-0.204
II	83229025	0.0	1001.55	0.398	0.00	6.451	-0.202
I	82265018	0.0	999.02	0.401	-2.00	6.637	-0.208
I	82265019	0.0	999.49	0.403	-2.00	6.643	-0.223
II	83229026	0.0	998.65	0.401	-1.99	6.418	-0.206
II	83229027	0.0	998.18	0.400	-1.99	6.412	-0.187
II	83229028	0.0	999.46	0.400	-1.99	6.428	-0.194

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83229029	0.0	1000.04	0.398	-1.99	6.436	-0.207
I	82265020	0.0	1001.72	0.399	-4.00	6.670	-0.208
I	82265021	0.0	1000.43	0.400	-4.00	6.654	-0.198
II	83229030	0.0	1000.15	0.402	-3.99	6.438	-0.185
II	83229031	0.0	1000.04	0.401	-3.99	6.436	-0.203
II	83229032	0.0	1000.15	0.401	-4.00	6.438	-0.183
II	83229033	0.0	1000.27	0.396	-4.00	6.440	-0.191
I	82265022	0.0	999.38	0.401	-6.00	6.643	-0.213
I	82265023	0.0	1000.08	0.400	-6.00	6.648	-0.214
I	82265024	0.0	999.02	0.402	-8.00	6.641	-0.218
I	82265025	0.0	999.38	0.401	-8.00	6.645	-0.219
I	82265026	0.0	998.55	0.402	-10.00	6.643	-0.313
I	82265027	0.0	998.91	0.403	-10.00	6.650	-0.318
I	82265028	0.0	1000.66	0.402	-12.00	6.682	-0.392
I	82265029	0.0	1000.90	0.402	-12.00	6.688	-0.374
I	82265030	0.0	1000.31	0.401	-14.00	6.701	-0.358
I	82265031	0.0	999.26	0.399	-14.00	6.688	-0.462
I	82265032	0.0	1001.37	0.400	-14.00	6.717	-0.474
I	82265034	0.0	999.73	0.396	-16.00	6.705	-0.471
I	82265035	0.0	1000.43	0.450	0.00	6.658	-0.237
I	82265036	0.0	999.49	0.451	0.00	6.646	-0.236
II	83229035	0.0	999.57	0.449	0.01	6.430	-0.221
II	83229036	0.0	999.69	0.448	0.00	6.430	-0.243
II	83229037	0.0	999.69	0.447	0.00	6.434	-0.216
I	82265037	0.0	1000.08	0.450	-2.00	6.654	-0.217
I	82265038	0.0	999.61	0.446	-2.00	6.650	-0.214
I	82265039	0.0	1000.08	0.450	-2.00	6.656	-0.209
I	82265040	0.0	999.73	0.451	-2.00	6.652	-0.227
II	83229038	0.0	999.69	0.449	-1.97	6.432	-0.212
II	83229039	0.0	1000.04	0.451	-1.97	6.438	-0.199
II	83229040	0.0	998.99	0.449	-1.98	6.426	-0.201
I	82265041	0.0	1000.66	0.452	-4.00	6.666	-0.205
I	82265042	0.0	999.61	0.450	-4.00	6.654	-0.201
II	83229042	0.0	999.57	0.451	-4.04	6.428	-0.194
II	83229043	0.0	999.57	0.453	-4.04	6.430	-0.195
II	83229044	0.0	1000.39	0.448	-4.04	6.441	-0.191
II	83229045	0.0	999.92	0.449	-4.04	6.434	-0.199
I	82265043	0.0	1000.55	0.450	-6.00	6.658	-0.200
I	82265044	0.0	1000.20	0.449	-6.00	6.656	-0.208
I	82265045	0.0	1000.78	0.453	-8.00	6.674	-0.261
I	82265046	0.0	999.49	0.451	-8.00	6.656	-0.272
I	82265047	0.0	1000.08	0.447	-10.00	6.678	-0.417
I	82265048	0.0	1000.55	0.449	-10.00	6.689	-0.463
I	82265049	0.0	1000.43	0.450	-12.00	6.699	-0.426
I	82265050	0.0	1000.43	0.450	-12.00	6.699	-0.488
I	82265051	0.0	998.44	0.451	-14.00	6.695	-0.477

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82265052	0.0	1000.78	0.450	-14.00	6.725	-0.598
I	82265053	0.0	1000.78	0.499	0.00	6.66R	-0.242
I	82265054	0.0	1000.66	0.500	0.00	6.664	-0.246
I	82265055	0.0	999.49	0.502	-2.00	6.654	-0.217
I	82265056	0.0	1000.20	0.501	-2.00	6.662	-0.244
I	82265057	0.0	999.14	0.505	-4.00	6.648	-0.210
I	82265058	0.0	999.14	0.503	-4.00	6.648	-0.199
I	82265059	0.0	999.96	0.500	-6.00	6.654	-0.235
I	82265060	0.0	1000.31	0.503	-6.00	6.658	-0.249
I	82265061	0.0	1000.66	0.503	-8.00	6.676	-0.394
I	82265062	0.0	999.96	0.501	-8.00	6.664	-0.406
I	82265063	0.0	999.61	0.500	-10.00	6.676	-0.528
I	82265064	0.0	999.38	0.500	-10.00	6.676	-0.581
I	82265065	0.0	1000.08	0.500	-12.00	6.697	-0.720
I	82265066	0.0	1000.90	0.499	-12.00	6.717	-0.566
I	82265067	0.0	1001.48	0.549	0.00	6.680	-0.241
I	82265068	0.0	1001.37	0.550	0.00	6.674	-0.246
I	82265069	0.0	999.61	0.552	-2.00	6.652	-0.220
I	82265070	0.0	999.84	0.550	-2.00	6.658	-0.234
I	82265071	0.0	999.14	0.551	-4.00	6.646	-0.194
I	82265072	0.0	999.84	0.550	-4.00	6.654	-0.206
I	82265073	0.0	999.84	0.554	-6.00	6.656	-0.326
I	82265074	0.0	998.67	0.557	-6.00	6.639	-0.355
I	82265075	0.0	1001.37	0.551	-8.00	6.688	-0.444
I	82265076	0.0	1000.43	0.550	-8.00	6.674	-0.464
I	82265077	0.0	1000.43	0.553	-10.00	6.699	-0.620
I	82265078	0.0	1000.78	0.553	-10.00	6.689	-0.620
II	83236010	3.0	1000.04	0.042	0.03	6.426	-0.300
II	83236011	3.0	999.81	0.042	0.03	6.424	-0.299
II	83229063	3.0	1000.73	0.043	-2.03	6.441	-0.300
II	83229064	3.0	1000.39	0.044	-2.03	6.438	-0.305
II	83229065	3.0	999.23	0.043	-4.03	6.424	-0.305
II	83229066	3.0	999.11	0.043	-4.03	6.422	-0.302
II	83229067	3.0	999.34	0.044	-6.06	6.424	-0.306
II	83229068	3.0	999.11	0.045	-6.06	6.424	-0.302
II	83229069	3.0	1000.39	0.044	-8.03	6.436	-0.305
II	83229070	3.0	1000.85	0.045	-8.03	6.441	-0.306
II	83229071	3.0	999.46	0.045	-10.02	6.426	-0.295
II	83229072	3.0	999.46	0.044	-10.02	6.426	-0.296
II	83236012	3.0	1000.62	0.044	-9.99	6.432	-0.291
II	83236013	3.0	1000.15	0.042	-10.02	6.426	-0.292
II	83229073	3.0	998.88	0.044	-12.04	6.418	-0.292
II	83229074	3.0	1000.50	0.043	-12.00	6.438	-0.292
II	83229075	3.0	998.99	0.043	-11.99	6.418	-0.296
II	83229076	3.0	999.81	0.043	-11.99	6.430	-0.296
II	83229077	3.0	998.76	0.043	-13.99	6.416	-0.296

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83229078	3.0	999.57	0.043	-13.98	6.426	-0.297
II	83229079	3.0	999.92	0.042	-16.01	6.430	-0.296
II	83229080	3.0	999.23	0.043	-16.01	6.420	-0.302
II	83229081	3.0	999.23	0.043	-18.04	6.422	-0.292
II	83229082	3.0	999.23	0.043	-18.04	6.422	-0.291
II	83229083	3.0	1000.39	0.044	-19.79	6.434	-0.286
II	83229084	3.0	1000.15	0.043	-19.79	6.432	-0.293
II	83229085	3.0	1000.15	0.043	-19.79	6.432	-0.286
II	83236014	3.0	999.57	0.043	-19.99	6.418	-0.295
II	83236015	3.0	999.23	0.042	-19.99	6.414	-0.288
II	83236016	3.0	999.23	0.041	-19.99	6.414	-0.288
II	83229086	3.0	999.81	0.093	0.07	6.434	-0.294
II	83229087	3.0	999.23	0.097	0.06	6.428	-0.298
II	83236017	3.0	998.53	0.095	0.02	6.412	-0.294
II	83236018	3.0	1000.04	0.094	0.01	6.430	-0.290
II	83229088	3.0	999.11	0.097	-1.98	6.426	-0.297
II	83229089	3.0	999.81	0.096	-1.98	6.432	-0.299
II	83229090	3.0	999.69	0.098	-4.04	6.430	-0.288
II	83229091	3.0	1000.39	0.097	-4.04	6.440	-0.294
II	83229092	3.0	999.11	0.097	-5.97	6.424	-0.296
II	83229093	3.0	999.11	0.097	-5.97	6.424	-0.293
II	83229094	3.0	999.34	0.099	-7.98	6.426	-0.296
II	83229095	3.0	999.81	0.099	-7.97	6.430	-0.295
II	83229096	3.0	1000.04	0.098	-10.04	6.434	-0.297
II	83229097	3.0	999.92	0.096	-10.03	6.432	-0.294
II	83236019	3.0	1000.27	0.096	-10.03	6.432	-0.296
II	83236020	3.0	999.69	0.097	-10.03	6.424	-0.296
II	83229098	3.0	999.57	0.097	-11.97	6.426	-0.292
II	83229099	3.0	999.46	0.100	-11.97	6.426	-0.292
II	83229100	3.0	1000.15	0.099	-13.99	6.432	-0.289
II	83229101	3.0	998.88	0.097	-13.94	6.418	-0.291
II	83229102	3.0	998.07	0.095	-15.98	6.409	-0.287
II	83229103	3.0	999.69	0.096	-15.98	6.426	-0.288
II	83229104	3.0	999.23	0.097	-17.99	6.420	-0.283
II	83229105	3.0	998.76	0.095	-17.98	6.414	-0.286
II	83229106	3.0	1000.15	0.095	-19.80	6.430	-0.287
II	83229107	3.0	999.46	0.096	-19.81	6.420	-0.285
II	83236021	3.0	999.92	0.098	-20.00	6.422	-0.277
II	83236022	3.0	999.69	0.097	-20.00	6.420	-0.285
II	83236023	3.0	1000.15	0.096	-19.99	6.424	-0.283
II	83236024	3.0	999.57	0.148	-4.02	6.426	-0.290
II	83236025	3.0	1000.97	0.148	-4.03	6.447	-0.304
II	83236026	3.0	1000.39	0.145	-6.00	6.436	-0.296
II	83236027	3.0	999.92	0.148	-6.00	6.430	-0.296
II	83236028	3.0	999.92	0.147	-8.03	6.428	-0.298
II	83236029	3.0	1000.27	0.150	-8.03	6.434	-0.293

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83236030	3.0	1000.04	0.147	-10.00	6.430	-0.293
II	83236031	3.0	1000.50	0.147	-10.00	6.436	-0.294
II	83236032	3.0	1001.32	0.147	-12.01	6.441	-0.286
II	83236033	3.0	999.34	0.148	-11.97	6.420	-0.284
II	83236034	3.0	999.69	0.146	-14.00	6.422	-0.285
II	83236035	3.0	1000.04	0.146	-14.00	6.426	-0.284
II	83236036	3.0	1000.85	0.149	-16.04	6.434	-0.282
II	83236037	3.0	1000.62	0.147	-16.04	6.432	-0.283
II	83236038	3.0	1000.73	0.146	-17.97	6.432	-0.271
II	83236039	3.0	1000.04	0.147	-17.97	6.424	-0.278
II	83236040	3.0	1001.08	0.148	-19.96	6.434	-0.274
II	83236041	3.0	1000.27	0.149	-19.97	6.426	-0.269
II	83236043	3.0	999.46	0.197	-8.07	6.426	-0.289
II	83236044	3.0	999.92	0.198	-8.07	6.432	-0.293
II	83236045	3.0	999.69	0.198	-10.03	6.428	-0.287
II	83236046	3.0	998.65	0.199	-10.03	6.414	-0.285
II	83236047	3.0	999.23	0.202	-12.00	6.420	-0.280
II	83236048	3.0	1000.39	0.195	-12.00	6.434	-0.281
II	83236049	3.0	1000.85	0.198	-13.93	6.438	-0.274
II	83236050	3.0	1001.32	0.199	-13.93	6.443	-0.274
II	83236051	3.0	1000.50	0.197	-15.97	6.432	-0.267
II	83236052	3.0	1000.27	0.197	-15.97	6.428	-0.261
II	83236053	3.0	1000.62	0.198	-17.98	6.432	-0.253
II	83236054	3.0	999.92	0.199	-17.98	6.426	-0.255
II	83236055	3.0	999.69	0.194	-19.94	6.424	-0.239
II	83236056	3.0	998.30	0.195	-19.94	6.409	-0.231
II	83236057	3.0	998.88	0.244	-8.04	6.420	-0.297
II	83236058	3.0	1000.04	0.249	-8.04	6.436	-0.293
II	83236059	3.0	999.69	0.248	-10.01	6.428	-0.287
II	83236060	3.0	999.23	0.248	-10.00	6.422	-0.282
II	83236061	3.0	999.57	0.250	-12.05	6.424	-0.269
II	83236062	3.0	999.57	0.250	-12.04	6.424	-0.269
II	83236063	3.0	999.46	0.250	-13.94	6.422	-0.238
II	83236064	3.0	999.69	0.250	-13.94	6.424	-0.260
II	83236065	3.0	999.34	0.248	-14.04	6.418	-0.255
II	83236066	3.0	1000.15	0.246	-14.04	6.430	-0.256
II	83236067	3.0	999.46	0.247	-15.97	6.426	-0.222
II	83236068	3.0	999.46	0.248	-15.97	6.426	-0.225
II	83236069	3.0	999.81	0.248	-18.05	6.432	-0.213
II	83236070	3.0	999.57	0.249	-18.05	6.428	-0.225
II	83236071	3.0	999.81	0.249	-18.04	6.428	-0.225
II	83236074	3.0	998.88	0.301	-9.96	6.420	-0.277
II	83236075	3.0	999.57	0.301	-9.96	6.426	-0.271
II	83236076	3.0	999.46	0.296	-12.05	6.426	-0.236
II	83236077	3.0	999.46	0.297	-12.05	6.420	-0.268
II	83236078	3.0	998.88	0.299	-12.07	6.414	-0.254

TABLE 9.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83236079	3.0	999.69	0.298	-12.07	6.428	-0.254
II	83236080	3.0	999.81	0.302	-14.04	6.434	-0.212
II	83236081	3.0	999.57	0.299	-14.04	6.428	-0.213
II	83236082	3.0	999.57	0.297	-15.99	6.428	-0.208
II	83236083	3.0	999.11	0.297	-15.99	6.422	-0.221
II	83236084	3.0	998.76	0.299	-15.99	6.418	-0.205
II	83236085	3.0	1000.15	0.299	-16.00	6.436	-0.204
II	83236086	3.0	1001.43	0.301	-17.97	6.449	-0.202
II	83236087	3.0	999.69	0.300	-17.97	6.428	-0.210
II	83236088	3.0	998.76	0.300	-17.97	6.418	-0.213
II	83236089	3.0	1000.04	0.299	-17.97	6.432	-0.211
II	83236090	3.0	998.99	0.345	-10.03	6.416	-0.261
II	83236091	3.0	999.92	0.347	-10.03	6.432	-0.258
II	83236092	3.0	998.76	0.349	-12.01	6.418	-0.206
II	83236093	3.0	998.65	0.350	-12.00	6.416	-0.217
II	83236094	3.0	1000.97	0.349	-12.00	6.443	-0.209
II	83236095	3.0	999.57	0.350	-12.00	6.424	-0.227
II	83236096	3.0	999.57	0.351	-14.01	6.430	-0.205
II	83236097	3.0	999.69	0.350	-14.01	6.428	-0.197
II	83236098	3.0	1000.27	0.348	-14.00	6.440	-0.201
II	83236099	3.0	1000.39	0.348	-15.97	6.440	-0.167
II	83236100	3.0	999.46	0.348	-15.97	6.430	-0.178
II	83236101	3.0	999.57	0.347	-15.97	6.426	-0.202
II	83236102	3.0	1000.97	0.347	-15.97	6.447	-0.178
II	83242024	6.0	999.46	0.042	-2.03	6.436	-0.597
II	83242025	6.0	999.23	0.044	-2.03	6.434	-0.534
II	83242026	6.0	1000.15	0.045	-2.02	6.440	-0.538
II	83242027	6.0	999.57	0.044	-1.99	6.432	-0.556
II	83242028	6.0	999.92	0.043	-3.99	6.441	-0.557
II	83242029	6.0	999.34	0.043	-3.96	6.432	-0.563
II	83242030	6.0	999.23	0.043	-6.04	6.432	-0.555
II	83242031	6.0	999.11	0.046	-6.03	6.434	-0.567
II	83242032	6.0	999.34	0.046	-8.07	6.436	-0.581
II	83242033	6.0	998.99	0.042	-8.07	6.432	-0.595
II	83242034	6.0	998.88	0.044	-10.00	6.428	-0.592
II	83242035	6.0	998.65	0.046	-10.00	6.428	-0.546
II	83242036	6.0	999.92	0.047	-10.00	6.443	-0.569
II	83242037	6.0	998.99	0.041	-12.04	6.430	-0.559
II	83242038	6.0	1000.27	0.041	-12.04	6.440	-0.562
II	83242039	6.0	1000.04	0.045	-14.03	6.440	-0.548
II	83242040	6.0	999.23	0.046	-14.04	6.430	-0.544
II	83242041	6.0	1000.04	0.045	-16.04	6.438	-0.560
II	83242042	6.0	999.23	0.045	-16.04	6.432	-0.546
II	83242043	6.0	998.30	0.044	-17.97	6.420	-0.589
II	83242044	6.0	999.81	0.042	-17.97	6.440	-0.597
II	83242045	6.0	999.81	0.044	-19.93	6.438	-0.576

TABLE 9.—CONCLUDED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83242046	6.0	999.46	0.047	-19.93	6.432	-0.592
II	83242047	6.0	999.57	0.043	-19.93	6.438	-0.578
II	83242048	6.0	999.34	0.042	-19.93	6.430	-0.566
II	83242049	6.0	1000.04	0.097	-15.98	6.441	-0.561
II	83242050	6.0	1000.15	0.097	-15.98	6.443	-0.550
II	83242051	6.0	1000.04	0.096	-18.02	6.440	-0.548
II	83242052	6.0	1000.15	0.097	-18.02	6.441	-0.552
II	83242053	6.0	1000.15	0.098	-19.97	6.443	-0.547
II	83242054	6.0	999.11	0.098	-19.96	6.430	-0.577
II	83242055	6.0	999.81	0.096	-19.97	6.438	-0.555
II	83242056	6.0	999.92	0.098	-19.97	6.441	-0.566
II	83242057	6.0	1000.85	0.148	-18.00	6.451	-0.573
II	83242058	6.0	1000.04	0.148	-18.00	6.440	-0.543
II	83242059	6.0	1000.27	0.147	-17.99	6.447	-0.558
II	83242060	6.0	1000.50	0.149	-19.95	6.440	-0.558
II	83242061	6.0	998.53	0.149	-19.98	6.418	-0.569

TABLE 10.—REGRESSING LEAD-LAG MODE DATA IN FORWARD FLIGHT, CONFIGURATION WITH STRUCTURAL FLAP-LAG COUPLING, 750 RPM

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83222048	0.0	749.54	0.095	-0.07	3.431	-0.150
II	83222049	0.0	750.46	0.093	-0.07	3.442	-0.150
II	83222050	0.0	751.39	0.093	-1.99	3.454	-0.147
II	83222051	0.0	749.42	0.093	-1.99	3.429	-0.145
II	83222052	0.0	749.19	0.093	-4.02	3.427	-0.144
II	83222053	0.0	749.88	0.093	-4.02	3.434	-0.145
II	83222054	0.0	750.70	0.092	-6.03	3.444	-0.144
II	83222055	0.0	750.35	0.092	-6.03	3.440	-0.142
II	83222056	0.0	750.46	0.093	-8.03	3.440	-0.139
II	83222057	0.0	750.93	0.093	-8.03	3.446	-0.138
II	83222058	0.0	749.88	0.093	-10.07	3.434	-0.137
II	83222059	0.0	750.12	0.096	-10.07	3.436	-0.138
II	83222060	0.0	750.70	0.095	-12.04	3.444	-0.138
II	83222061	0.0	750.58	0.097	-12.04	3.442	-0.137
II	83222062	0.0	750.35	0.096	-12.04	3.438	-0.133
II	83222063	0.0	751.39	0.096	-12.05	3.452	-0.136
II	83222064	0.0	751.74	0.096	-14.04	3.458	-0.140
II	83222065	0.0	750.93	0.098	-14.04	3.448	-0.141
II	83222066	0.0	751.97	0.099	-15.96	3.461	-0.148
II	83222067	0.0	750.46	0.098	-15.96	3.442	-0.146
II	83222068	0.0	751.04	0.096	-15.96	3.450	-0.148
II	83222069	0.0	751.39	0.098	-18.02	3.456	-0.163
II	83222070	0.0	750.93	0.095	-18.02	3.452	-0.162
II	83222071	0.0	750.81	0.096	-19.64	3.450	-0.173
II	83222072	0.0	750.81	0.094	-19.64	3.450	-0.170
II	83222073	0.0	748.96	0.149	-0.09	3.425	-0.152
II	83222074	0.0	749.19	0.150	-0.09	3.427	-0.150
II	83223002	0.0	750.00	0.150	0.00	3.434	-0.153
II	83223003	0.0	750.00	0.150	0.00	3.434	-0.156
II	83223004	0.0	750.00	0.150	0.00	3.425	-0.152
II	83222075	0.0	750.12	0.146	-2.00	3.438	-0.148
II	83222076	0.0	750.00	0.148	-2.00	3.436	-0.147
II	83222077	0.0	749.42	0.150	-4.04	3.429	-0.145
II	83222078	0.0	749.54	0.147	-4.04	3.431	-0.144
II	83222079	0.0	749.65	0.149	-6.01	3.431	-0.141
II	83222080	0.0	749.54	0.149	-6.02	3.429	-0.141
II	83222081	0.0	750.12	0.149	-7.93	3.436	-0.138
II	83222082	0.0	750.35	0.146	-7.92	3.440	-0.138
II	83222083	0.0	749.65	0.149	-10.00	3.432	-0.149
II	83222084	0.0	750.00	0.150	-10.00	3.436	-0.146
II	83222085	0.0	750.46	0.149	-12.01	3.446	-0.172
II	83222086	0.0	750.46	0.146	-12.01	3.446	-0.166
II	83222087	0.0	750.12	0.148	-12.01	3.440	-0.169
II	83223005	0.0	750.00	0.150	-12.00	3.434	-0.176
II	83223006	0.0	750.00	0.150	-12.00	3.434	-0.171
II	83223007	0.0	750.00	0.150	-14.00	3.446	-0.190

TABLE 10.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83223008	0.0	750.00	0.150	-14.00	3.448	-0.184
II	83223009	0.0	750.00	0.150	-14.00	3.448	-0.194
II	83223011	0.0	750.00	0.150	-16.00	3.435	-0.201
II	83223012	0.0	750.00	0.150	-16.00	3.431	-0.196
II	83223013	0.0	750.00	0.150	-16.00	3.436	-0.198
II	83223014	0.0	750.00	0.150	-18.00	3.440	-0.195
II	83223015	0.0	750.00	0.150	-18.00	3.450	-0.202
II	83223016	0.0	750.00	0.150	-20.00	3.432	-0.198
II	83223017	0.0	750.00	0.150	-20.00	3.432	-0.198
II	83223018	0.0	750.00	0.200	0.00	3.438	-0.159
II	83223019	0.0	750.00	0.200	0.00	3.438	-0.160
II	83223020	0.0	750.00	0.200	-2.00	3.432	-0.148
II	83223021	0.0	750.00	0.200	-2.00	3.434	-0.154
II	83223022	0.0	750.00	0.200	-4.00	3.440	-0.148
II	83223023	0.0	750.00	0.200	-4.00	3.440	-0.144
II	83223024	0.0	750.00	0.200	-6.00	3.444	-0.149
II	83223025	0.0	750.00	0.200	-6.00	3.433	-0.140
II	83223026	0.0	750.00	0.200	-8.00	3.431	-0.160
II	83223027	0.0	750.00	0.200	-8.00	3.436	-0.164
II	83223028	0.0	750.00	0.200	-10.00	3.442	-0.182
II	83223029	0.0	750.00	0.200	-10.00	3.438	-0.191
II	83223030	0.0	750.00	0.200	-10.00	3.438	-0.188
II	83223031	0.0	750.00	0.200	-12.00	3.442	-0.193
II	83223032	0.0	750.00	0.200	-12.00	3.431	-0.198
II	83223033	0.0	750.00	0.200	-14.00	3.452	-0.192
II	83223034	0.0	750.00	0.200	-14.00	3.413	-0.189
II	83223035	0.0	750.00	0.200	-16.00	3.440	-0.201
II	83223036	0.0	750.00	0.200	-16.00	3.444	-0.205
II	83223037	0.0	750.00	0.200	-18.00	3.448	-0.201
II	83223038	0.0	750.00	0.200	-18.00	3.450	-0.204
II	83223041	0.0	748.61	0.249	0.00	3.417	-0.159
II	83223042	0.0	751.16	0.248	-0.01	3.452	-0.160
II	83223043	0.0	750.46	0.245	-2.04	3.440	-0.155
II	83223044	0.0	750.12	0.248	-2.04	3.436	-0.161
II	83223045	0.0	749.07	0.248	-3.99	3.427	-0.151
II	83223046	0.0	749.30	0.250	-3.99	3.427	-0.151
II	83223047	0.0	748.84	0.251	-6.03	3.423	-0.161
II	83223048	0.0	748.38	0.250	-6.03	3.419	-0.159
II	83223049	0.0	748.38	0.251	-8.07	3.419	-0.181
II	83223050	0.0	749.54	0.250	-8.07	3.436	-0.169
II	83223051	0.0	748.61	0.253	-8.07	3.423	-0.184
II	83223052	0.0	750.93	0.250	-8.03	3.454	-0.179
II	83223053	0.0	751.28	0.251	-10.03	3.454	-0.196
II	83223054	0.0	750.93	0.251	-10.03	3.454	-0.184
II	83223055	0.0	750.81	0.251	-10.03	3.448	-0.196
II	83223056	0.0	751.28	0.249	-11.97	3.460	-0.198

TABLE 10.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83223057	0.0	751.16	0.252	-11.96	3.454	-0.199
II	83223058	0.0	750.58	0.245	-14.07	3.452	-0.189
II	83223059	0.0	749.88	0.248	-14.07	3.442	-0.176
II	83223060	0.0	749.30	0.247	-14.04	3.438	-0.167
II	83223063	0.0	748.96	0.294	0.02	3.427	-0.169
II	83223064	0.0	749.19	0.295	0.01	3.427	-0.159
II	83223066	0.0	749.77	0.296	-0.06	3.436	-0.165
II	83223067	0.0	747.68	0.300	-2.02	3.411	-0.156
II	83223068	0.0	750.00	0.301	-2.02	3.438	-0.153
II	83223069	0.0	750.00	0.296	-2.02	3.440	-0.158
II	83223086	0.0	750.46	0.296	-2.02	3.444	-0.156
II	83223070	0.0	750.00	0.300	-3.99	3.440	-0.137
II	83223073	0.0	748.38	0.297	-4.06	3.419	-0.147
II	83223074	0.0	750.81	0.302	-4.02	3.450	-0.150
II	83223075	0.0	750.93	0.298	-4.02	3.452	-0.151
II	83223076	0.0	749.65	0.299	-6.00	3.438	-0.164
II	83223077	0.0	751.04	0.297	-5.99	3.454	-0.169
II	83223078	0.0	750.23	0.295	-5.99	3.444	-0.167
II	83223079	0.0	748.49	0.299	-7.99	3.427	-0.185
II	83223080	0.0	749.54	0.302	-7.99	3.440	-0.166
II	83223081	0.0	748.61	0.299	-7.99	3.425	-0.173
II	83223082	0.0	749.88	0.299	-7.99	3.442	-0.180
II	83223083	0.0	750.35	0.302	-10.03	3.452	-0.187
II	83223084	0.0	749.19	0.303	-10.03	3.432	-0.187
II	83223085	0.0	749.77	0.298	-10.03	3.442	-0.193
II	83223087	0.0	750.23	0.347	0.02	3.444	-0.165
II	83223088	0.0	750.46	0.346	0.02	3.446	-0.173
II	83223089	0.0	750.58	0.349	-0.01	3.442	-0.188
II	83223090	0.0	750.12	0.348	-1.99	3.442	-0.159
II	83223091	0.0	749.88	0.350	-1.99	3.438	-0.158
II	83223092	0.0	749.77	0.351	-4.00	3.438	-0.154
II	83223093	0.0	750.12	0.347	-3.99	3.442	-0.152
II	83223094	0.0	749.42	0.348	-6.03	3.434	-0.173
II	83223095	0.0	749.65	0.348	-6.03	3.436	-0.165
II	83223096	0.0	750.23	0.350	-6.03	3.446	-0.170
II	83223097	0.0	749.88	0.354	-8.00	3.440	-0.168
II	83223098	0.0	749.19	0.351	-8.02	3.434	-0.158
II	83223099	0.0	749.19	0.348	-8.04	3.434	-0.192
II	83223100	0.0	750.00	0.397	-0.05	3.442	-0.166
II	83223101	0.0	750.00	0.395	-0.01	3.442	-0.170
II	83223102	0.0	750.00	0.400	-2.02	3.440	-0.161
II	83223103	0.0	750.23	0.401	-2.02	3.444	-0.181
II	83223104	0.0	750.23	0.400	-3.96	3.446	-0.149
II	83223105	0.0	748.61	0.402	-3.99	3.425	-0.162
II	83223106	0.0	750.81	0.399	-3.99	3.450	-0.151
II	83223107	0.0	750.93	0.399	-3.99	3.452	-0.153

TABLE 10.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83223108	0.0	751.51	0.399	-6.03	3.460	-0.158
II	83223109	0.0	751.51	0.400	-6.03	3.460	-0.162
II	83223110	0.0	749.54	0.447	-0.09	3.436	-0.179
II	83223111	0.0	750.35	0.447	-0.10	3.446	-0.177
II	83223112	0.0	749.19	0.451	-1.99	3.431	-0.177
II	83223113	0.0	749.30	0.451	-1.99	3.431	-0.173
II	83223114	0.0	749.19	0.450	-3.99	3.434	-0.157
II	83223115	0.0	750.12	0.449	-3.99	3.442	-0.157
II	83255005	3.0	749.77	0.093	-0.01	3.440	-0.250
II	83255006	3.0	750.12	0.093	-0.01	3.444	-0.252
II	83255007	3.0	750.23	0.095	-2.03	3.444	-0.253
II	83255008	3.0	749.65	0.095	-2.02	3.436	-0.262
II	83255009	3.0	750.58	0.094	-2.02	3.450	-0.254
II	83255010	3.0	749.54	0.094	-3.99	3.436	-0.245
II	83255011	3.0	751.16	0.095	-3.98	3.458	-0.257
II	83255012	3.0	750.58	0.096	-3.98	3.450	-0.261
II	83255013	3.0	749.54	0.095	-3.98	3.436	-0.263
II	83255014	3.0	750.12	0.095	-6.06	3.444	-0.253
II	83255015	3.0	749.42	0.095	-6.06	3.434	-0.252
II	83255016	3.0	750.00	0.095	-7.99	3.440	-0.255
II	83255017	3.0	749.19	0.095	-7.99	3.431	-0.257
II	83255018	3.0	749.19	0.096	-10.00	3.431	-0.256
II	83255019	3.0	750.00	0.097	-10.00	3.440	-0.254
II	83255020	3.0	749.42	0.095	-11.96	3.434	-0.255
II	83255021	3.0	749.42	0.094	-11.96	3.434	-0.256
II	83255022	3.0	750.00	0.094	-13.99	3.440	-0.251
II	83255023	3.0	750.12	0.094	-13.99	3.442	-0.249
II	83255024	3.0	750.58	0.095	-15.93	3.448	-0.249
II	83255025	3.0	749.77	0.095	-15.93	3.438	-0.248
II	83255026	3.0	749.88	0.095	-18.04	3.438	-0.244
II	83255027	3.0	750.46	0.095	-18.04	3.446	-0.249
II	83255028	3.0	750.12	0.095	-18.04	3.442	-0.243
II	83255029	3.0	748.72	0.095	-18.04	3.423	-0.245
II	83255030	3.0	749.19	0.095	-19.96	3.429	-0.241
II	83255031	3.0	750.35	0.095	-19.96	3.444	-0.243
II	83255032	3.0	749.65	0.094	-19.96	3.434	-0.245
II	83255035	3.0	750.35	0.149	-3.96	3.454	-0.257
II	83255036	3.0	750.35	0.151	-3.96	3.454	-0.258
II	83255037	3.0	749.88	0.150	-6.04	3.446	-0.257
II	83255038	3.0	749.65	0.150	-6.04	3.444	-0.256
II	83255039	3.0	750.12	0.150	-8.07	3.448	-0.254
II	83255040	3.0	749.30	0.150	-8.07	3.438	-0.258
II	83255041	3.0	750.12	0.150	-10.04	3.448	-0.252
II	83255042	3.0	750.35	0.149	-10.07	3.452	-0.251
II	83255043	3.0	750.46	0.149	-12.02	3.450	-0.245
II	83255044	3.0	749.88	0.152	-12.01	3.444	-0.249

TABLE 10.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83255045	3.0	748.72	0.152	-14.04	3.429	-0.244
II	83255046	3.0	749.77	0.151	-14.04	3.442	-0.244
II	83255047	3.0	749.07	0.150	-16.08	3.431	-0.241
II	83255048	3.0	748.96	0.151	-16.08	3.429	-0.242
II	83255049	3.0	749.88	0.151	-18.05	3.438	-0.240
II	83255050	3.0	750.93	0.150	-18.05	3.450	-0.241
II	83255051	3.0	750.58	0.151	-19.97	3.444	-0.239
II	83255052	3.0	749.42	0.151	-19.97	3.431	-0.232
II	83255053	3.0	749.65	0.152	-19.98	3.434	-0.239
II	83255054	3.0	750.23	0.150	-19.98	3.440	-0.233
II	83256004	3.0	749.77	0.197	-6.02	3.438	-0.264
II	83256005	3.0	749.30	0.198	-6.02	3.432	-0.256
II	83256006	3.0	749.88	0.200	-6.02	3.440	-0.256
II	83256007	3.0	748.96	0.201	-8.02	3.427	-0.256
II	83256008	3.0	748.72	0.200	-8.02	3.425	-0.263
II	83256009	3.0	748.96	0.199	-8.02	3.427	-0.255
II	83256010	3.0	750.58	0.195	-10.06	3.446	-0.249
II	83256011	3.0	750.58	0.197	-10.06	3.446	-0.247
II	83256012	3.0	750.58	0.196	-10.06	3.448	-0.248
II	83256013	3.0	750.46	0.198	-11.95	3.444	-0.244
II	83256014	3.0	750.93	0.198	-11.95	3.448	-0.243
II	83256015	3.0	748.84	0.195	-11.95	3.423	-0.244
II	83256016	3.0	750.00	0.196	-14.06	3.434	-0.229
II	83256017	3.0	750.00	0.198	-14.06	3.434	-0.240
II	83256018	3.0	750.00	0.196	-14.06	3.434	-0.235
II	83256019	3.0	749.30	0.198	-14.06	3.427	-0.237
II	83256020	3.0	750.35	0.198	-15.93	3.436	-0.239
II	83256021	3.0	750.23	0.197	-15.93	3.434	-0.250
II	83256022	3.0	750.81	0.198	-15.93	3.442	-0.238
II	83256023	3.0	750.70	0.197	-15.93	3.440	-0.226
II	83256024	3.0	750.12	0.198	-17.97	3.434	-0.230
II	83256025	3.0	749.77	0.197	-17.97	3.432	-0.223
II	83256026	3.0	749.30	0.196	-17.97	3.425	-0.229
II	83256027	3.0	749.07	0.198	-17.97	3.421	-0.224
II	83256028	3.0	749.30	0.201	-19.99	3.429	-0.209
II	83256029	3.0	748.84	0.202	-19.98	3.423	-0.221
II	83256030	3.0	750.23	0.201	-20.00	3.442	-0.223
II	83256031	3.0	749.88	0.200	-20.00	3.436	-0.218
II	83256034	3.0	749.54	0.249	-6.02	3.438	-0.253
II	83256035	3.0	749.07	0.248	-6.03	3.432	-0.264
II	83256036	3.0	750.12	0.249	-6.03	3.446	-0.262
II	83256037	3.0	749.30	0.253	-6.03	3.434	-0.261
II	83256038	3.0	748.72	0.243	-7.99	3.429	-0.249
II	83256039	3.0	750.00	0.248	-7.99	3.444	-0.253
II	83256040	3.0	749.19	0.248	-7.99	3.432	-0.244
II	83256041	3.0	748.72	0.247	-10.00	3.425	-0.242

TABLE 10.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83256042	3.0	748.96	0.245	-10.03	3.427	-0.243
II	83256043	3.0	749.30	0.247	-10.03	3.432	-0.245
II	83256044	3.0	748.72	0.244	-12.04	3.421	-0.234
II	83256045	3.0	748.72	0.250	-12.04	3.421	-0.226
II	83256046	3.0	750.93	0.251	-12.04	3.450	-0.240
II	83256047	3.0	750.12	0.251	-12.04	3.438	-0.240
II	83256048	3.0	750.70	0.249	-14.04	3.446	-0.231
II	83256049	3.0	750.23	0.243	-14.04	3.438	-0.223
II	83256050	3.0	749.77	0.242	-14.04	3.434	-0.236
II	83256051	3.0	748.72	0.248	-14.04	3.421	-0.224
II	83256052	3.0	749.65	0.248	-16.04	3.436	-0.213
II	83256053	3.0	749.42	0.259	-16.04	3.436	-0.213
II	83256054	3.0	749.77	0.253	-16.04	3.438	-0.220
II	83256055	3.0	749.65	0.252	-17.98	3.442	-0.206
II	83256056	3.0	750.35	0.250	-17.98	3.450	-0.211
II	83256057	3.0	749.07	0.252	-17.98	3.434	-0.192
II	83256058	3.0	749.88	0.246	-17.98	3.444	-0.202
II	83256059	3.0	749.42	0.250	-19.97	3.438	-0.206
II	83256060	3.0	750.12	0.248	-19.98	3.446	-0.204
II	83256061	3.0	749.77	0.248	-19.98	3.442	-0.216
II	83256062	3.0	749.77	0.249	-19.98	3.442	-0.208
II	83256063	3.0	749.30	0.296	-8.02	3.434	-0.245
II	83256064	3.0	749.54	0.298	-8.04	3.436	-0.251
II	83256065	3.0	750.23	0.300	-8.03	3.444	-0.251
II	83256073	3.0	748.96	0.299	-7.99	3.429	-0.245
II	83256074	3.0	749.19	0.297	-8.00	3.432	-0.247
II	83258004	3.0	749.88	0.300	-7.99	3.436	-0.248
II	83258005	3.0	751.16	0.300	-7.99	3.452	-0.250
II	83256066	3.0	749.88	0.302	-10.01	3.438	-0.233
II	83256067	3.0	749.65	0.301	-10.01	3.432	-0.236
II	83256068	3.0	750.00	0.300	-10.01	3.438	-0.239
II	83256069	3.0	750.12	0.299	-10.01	3.442	-0.239
II	83258006	3.0	749.42	0.298	-10.05	3.429	-0.240
II	83258007	3.0	750.35	0.298	-10.03	3.438	-0.232
II	83258008	3.0	750.00	0.296	-10.06	3.434	-0.243
II	83258009	3.0	751.51	0.298	-10.06	3.454	-0.238
II	83258010	3.0	749.88	0.300	-12.00	3.431	-0.240
II	83258011	3.0	750.00	0.301	-12.00	3.432	-0.228
II	83258012	3.0	750.35	0.299	-11.99	3.440	-0.232
II	83258013	3.0	750.12	0.300	-12.00	3.432	-0.226
II	83258014	3.0	751.16	0.298	-13.96	3.454	-0.198
II	83258015	3.0	751.16	0.298	-13.96	3.454	-0.204
II	83258016	3.0	750.23	0.299	-13.96	3.444	-0.203
II	83258017	3.0	750.35	0.295	-13.96	3.446	-0.207
II	83258018	3.0	749.42	0.300	-16.11	3.434	-0.204
II	83258019	3.0	751.16	0.299	-16.11	3.458	-0.210

TABLE 10.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83258020	3.0	750.12	0.300	-16.11	3.442	-0.187
II	83258021	3.0	750.35	0.303	-16.11	3.446	-0.205
II	83258022	3.0	750.23	0.295	-17.98	3.444	-0.198
II	83258023	3.0	749.19	0.298	-17.97	3.434	-0.207
II	83258024	3.0	750.00	0.296	-17.98	3.444	-0.191
II	83258025	3.0	750.00	0.298	-17.97	3.444	-0.188
II	83258026	3.0	750.12	0.299	-20.00	3.450	-0.189
II	83258027	3.0	750.35	0.300	-20.00	3.454	-0.191
II	83258028	3.0	749.54	0.301	-20.00	3.446	-0.189
II	83258029	3.0	749.77	0.301	-20.00	3.450	-0.171
II	83258034	3.0	749.88	0.348	-8.00	3.440	-0.240
II	83258035	3.0	749.88	0.351	-8.00	3.444	-0.256
II	83258036	3.0	750.00	0.348	-8.00	3.442	-0.252
II	83258041	3.0	749.54	0.347	-8.00	3.434	-0.240
II	83258042	3.0	749.77	0.351	-8.00	3.436	-0.221
II	83258043	3.0	749.30	0.351	-8.00	3.432	-0.228
II	83258044	3.0	748.84	0.348	-8.00	3.427	-0.234
II	83258045	3.0	750.00	0.349	-10.00	3.438	-0.212
II	83258046	3.0	750.81	0.353	-10.03	3.450	-0.220
II	83258047	3.0	748.72	0.352	-10.02	3.423	-0.207
II	83258048	3.0	749.30	0.353	-10.03	3.429	-0.233
II	83258049	3.0	749.77	0.349	-12.04	3.440	-0.182
II	83258050	3.0	749.65	0.348	-12.04	3.434	-0.196
II	83258051	3.0	748.72	0.351	-12.04	3.427	-0.194
II	83258052	3.0	750.00	0.348	-12.04	3.440	-0.203
II	83258053	3.0	748.49	0.352	-14.01	3.425	-0.186
II	83258054	3.0	748.49	0.348	-14.00	3.427	-0.165
II	83258055	3.0	749.65	0.351	-14.00	3.442	-0.176
II	83258056	3.0	750.00	0.352	-14.00	3.444	-0.187
II	83258057	3.0	751.39	0.349	-16.01	3.467	-0.176
II	83258058	3.0	750.46	0.350	-16.01	3.458	-0.181
II	83258059	3.0	749.65	0.349	-16.01	3.440	-0.177
II	83258060	3.0	749.30	0.350	-16.01	3.440	-0.184
II	83258061	3.0	750.12	0.348	-18.00	3.456	-0.144
II	83258062	3.0	750.46	0.347	-17.99	3.461	-0.187
II	83258063	3.0	749.30	0.348	-17.99	3.448	-0.185
II	83258064	3.0	750.12	0.345	-17.99	3.456	-0.174
II	83259028	6.0	749.77	0.094	-12.06	3.456	-0.588
II	83259029	6.0	749.54	0.093	-12.07	3.448	-0.578
II	83259030	6.0	749.77	0.091	-12.07	3.454	-0.572
II	83259031	6.0	750.23	0.093	-14.00	3.460	-0.581
II	83259032	6.0	750.12	0.091	-14.00	3.456	-0.577
II	83259033	6.0	749.19	0.093	-16.04	3.448	-0.581
II	83259034	6.0	749.07	0.093	-16.04	3.444	-0.581
II	83259035	6.0	749.19	0.096	-17.97	3.446	-0.564
II	83259036	6.0	749.54	0.094	-17.97	3.450	-0.574

TABLE 10.—CONCLUDED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83259037	6.0	750.70	0.093	-19.98	3.465	-0.578
II	83259038	6.0	750.23	0.094	-19.98	3.456	-0.580
II	83259039	6.0	749.77	0.148	-16.05	3.454	-0.570
II	83259040	6.0	750.23	0.148	-16.05	3.460	-0.567
II	83259041	6.0	750.35	0.148	-18.01	3.460	-0.577
II	83259042	6.0	749.19	0.149	-18.01	3.442	-0.575
II	83259043	6.0	749.30	0.144	-20.00	3.446	-0.567
II	83259044	6.0	748.26	0.143	-20.00	3.429	-0.575
II	83259045	6.0	750.58	0.195	-15.97	3.461	-0.578
II	83259046	6.0	749.65	0.196	-15.97	3.450	-0.570
II	83259047	6.0	748.96	0.197	-18.01	3.438	-0.573
II	83259048	6.0	749.19	0.196	-18.01	3.440	-0.561
II	83259049	6.0	750.23	0.195	-20.00	3.450	-0.575
II	83259050	6.0	749.19	0.196	-20.00	3.438	-0.586

TABLE 11.—REGRESSING LEAD-LAG MODE DATA IN FORWARD FLIGHT, CONFIGURATION WITH STRUCTURAL FLAP-LAG COUPLING, 1000 RPM

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83223120	0.0	999.69	0.044	0.02	6.428	-0.184
II	83223121	0.0	1000.62	0.042	0.02	6.440	-0.163
II	83223122	0.0	999.34	0.043	-1.97	6.426	-0.163
II	83223123	0.0	999.23	0.044	-1.97	6.422	-0.162
II	83223124	0.0	997.95	0.045	-4.02	6.409	-0.161
II	83223125	0.0	997.60	0.044	-4.04	6.405	-0.163
II	83223126	0.0	1000.39	0.044	-6.04	6.436	-0.160
II	83223127	0.0	1000.62	0.044	-6.04	6.438	-0.163
II	83223128	0.0	999.92	0.045	-8.03	6.432	-0.162
II	83223129	0.0	1000.15	0.044	-8.03	6.432	-0.160
II	83223130	0.0	1000.15	0.044	-10.00	6.432	-0.161
II	83223131	0.0	999.81	0.044	-10.00	6.428	-0.162
II	83223132	0.0	999.34	0.044	-11.97	6.422	-0.160
II	83223133	0.0	999.34	0.043	-11.97	6.422	-0.158
II	83223134	0.0	1000.04	0.043	-14.00	6.430	-0.157
II	83223135	0.0	999.92	0.043	-14.00	6.430	-0.158
II	83223136	0.0	999.92	0.043	-16.04	6.430	-0.157
II	83223137	0.0	999.46	0.043	-16.04	6.424	-0.158
II	83223138	0.0	998.41	0.043	-17.98	6.411	-0.155
II	83223139	0.0	999.81	0.043	-17.98	6.428	-0.158
II	83223140	0.0	1000.85	0.043	-19.64	6.441	-0.157
II	83223141	0.0	1000.15	0.043	-19.64	6.434	-0.157
II	83224004	0.0	1000.04	0.097	0.00	6.430	-0.168
II	83224005	0.0	999.11	0.096	0.00	6.416	-0.164
II	83224006	0.0	999.57	0.095	0.00	6.422	-0.167
II	83224029	0.0	999.34	0.095	-0.01	6.422	-0.169
II	83224007	0.0	999.92	0.096	-2.01	6.428	-0.169
II	83224008	0.0	998.65	0.097	-2.01	6.412	-0.167
II	83224009	0.0	998.88	0.097	-3.98	6.414	-0.166
II	83224010	0.0	999.23	0.097	-3.98	6.418	-0.168
II	83224011	0.0	1001.32	0.097	-5.98	6.443	-0.162
II	83224012	0.0	1000.27	0.097	-5.96	6.432	-0.168
II	83224013	0.0	998.99	0.098	-5.96	6.418	-0.166
II	83224014	0.0	1000.04	0.099	-7.99	6.428	-0.163
II	83224015	0.0	999.34	0.099	-7.99	6.420	-0.165
II	83224016	0.0	1000.85	0.099	-10.00	6.438	-0.164
II	83224017	0.0	1000.27	0.097	-10.00	6.430	-0.164
II	83224018	0.0	1000.97	0.097	-12.04	6.438	-0.168
II	83224019	0.0	1001.43	0.097	-12.04	6.443	-0.176
II	83224020	0.0	1001.55	0.097	-12.02	6.447	-0.172
II	83224021	0.0	999.46	0.097	-13.96	6.426	-0.186
II	83224022	0.0	999.69	0.097	-13.96	6.428	-0.184
II	83224023	0.0	998.88	0.097	-16.01	6.418	-0.200
II	83224024	0.0	998.53	0.097	-16.00	6.414	-0.199
II	83224025	0.0	1000.04	0.096	-17.97	6.432	-0.203
II	83224026	0.0	998.53	0.096	-17.97	6.414	-0.206

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83224027	0.0	999.57	0.096	-19.64	6.426	-0.204
II	83224028	0.0	999.11	0.095	-19.65	6.420	-0.204
I	82263003	0.0	1000.08	0.149	0.00	6.639	-0.194
I	82263005	0.0	1001.13	0.142	0.00	6.639	-0.179
I	82263017	0.0	999.38	0.149	0.00	6.639	-0.175
II	83224032	0.0	998.30	0.148	0.00	6.412	-0.170
II	83224033	0.0	1000.04	0.148	0.00	6.434	-0.174
II	83224058	0.0	1000.15	0.146	0.02	6.434	-0.163
II	83224059	0.0	999.57	0.152	0.01	6.428	-0.170
I	82263004	0.0	1000.31	0.149	-2.00	6.652	-0.180
I	82263006	0.0	1000.08	0.146	-2.00	6.652	-0.176
I	82263018	0.0	1000.08	0.148	-2.00	6.639	-0.174
II	83224034	0.0	1000.27	0.146	-2.02	6.436	-0.169
II	83224035	0.0	1000.39	0.150	-2.02	6.438	-0.169
I	82263007	0.0	1000.08	0.148	-4.00	6.639	-0.176
I	82263008	0.0	999.96	0.148	-4.00	6.639	-0.172
I	82263019	0.0	1000.08	0.149	-4.00	6.639	-0.173
II	83224036	0.0	999.34	0.150	-4.02	6.424	-0.165
II	83224037	0.0	999.57	0.147	-4.02	6.428	-0.166
I	82263009	0.0	999.96	0.148	-6.00	6.639	-0.176
I	82263020	0.0	999.61	0.148	-6.00	6.639	-0.168
I	82263021	0.0	1000.31	0.148	-6.00	6.639	-0.172
II	83224038	0.0	1000.97	0.150	-5.99	6.443	-0.162
II	83224039	0.0	1000.39	0.148	-5.99	6.438	-0.176
II	83224040	0.0	998.41	0.148	-5.99	6.414	-0.160
II	83224041	0.0	999.92	0.148	-6.00	6.432	-0.162
I	82263010	0.0	1000.43	0.149	-8.00	6.639	-0.177
I	82263022	0.0	999.84	0.147	-8.00	6.639	-0.175
II	83224042	0.0	999.46	0.148	-7.99	6.424	-0.173
II	83224043	0.0	999.46	0.148	-7.99	6.428	-0.170
I	82263011	0.0	999.84	0.149	-10.00	6.639	-0.198
I	82263023	0.0	999.96	0.148	-10.00	6.639	-0.190
II	83224044	0.0	1001.08	0.148	-10.03	6.447	-0.189
II	83224045	0.0	999.23	0.148	-10.03	6.426	-0.187
I	82263012	0.0	999.38	0.149	-12.00	6.639	-0.207
I	82263024	0.0	1000.31	0.148	-12.00	6.639	-0.202
II	83224046	0.0	1000.15	0.150	-12.07	6.438	-0.205
II	83224047	0.0	1000.27	0.149	-12.08	6.438	-0.193
II	83224048	0.0	1000.15	0.150	-12.08	6.436	-0.200
I	82263013	0.0	1000.78	0.148	-14.00	6.639	-0.212
I	82263025	0.0	1000.08	0.147	-14.00	6.654	-0.212
II	83224049	0.0	1000.15	0.149	-14.00	6.436	-0.207
II	83224050	0.0	999.81	0.149	-14.00	6.432	-0.208
I	82263014	0.0	999.26	0.147	-16.00	6.639	-0.212
I	82263026	0.0	999.96	0.147	-16.00	6.652	-0.210
II	83224051	0.0	1001.66	0.149	-16.02	6.453	-0.202

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83224052	0.0	1000.62	0.148	-16.03	6.440	-0.202
I	82263015	0.0	999.84	0.148	-18.00	6.639	-0.205
I	82263027	0.0	999.84	0.148	-18.00	6.648	-0.210
II	83224053	0.0	999.81	0.148	-18.00	6.432	-0.212
II	83224054	0.0	999.23	0.147	-17.99	6.424	-0.207
II	83224055	0.0	998.88	0.147	-17.99	6.420	-0.208
I	82263016	0.0	1000.08	0.148	-20.00	6.639	-0.207
I	82263028	0.0	1000.43	0.148	-20.00	6.658	-0.201
II	83224056	0.0	1001.20	0.147	-19.64	6.447	-0.209
II	83224057	0.0	1000.39	0.147	-19.64	6.438	-0.206
I	82263029	0.0	1000.55	0.202	0.00	6.658	-0.180
I	82264001	0.0	999.84	0.199	0.00	6.643	-0.186
I	82264002	0.0	1001.72	0.200	0.00	6.664	-0.179
II	83224062	0.0	998.18	0.199	0.02	6.412	-0.169
II	83224063	0.0	999.57	0.199	0.02	6.428	-0.178
II	83224064	0.0	999.92	0.197	0.02	6.434	-0.172
I	82263030	0.0	1001.25	0.200	-2.00	6.668	-0.179
I	82264003	0.0	1000.55	0.199	-2.00	6.650	-0.180
I	82264004	0.0	1001.13	0.198	-2.00	6.658	-0.186
II	83224065	0.0	998.99	0.201	-2.06	6.424	-0.169
II	83224066	0.0	999.46	0.198	-2.06	6.428	-0.167
I	82263031	0.0	1000.78	0.201	-4.00	6.660	-0.177
I	82264005	0.0	1000.90	0.201	-4.00	6.656	-0.185
I	82264007	0.0	1000.20	0.200	-4.00	6.646	-0.178
II	83224067	0.0	1001.43	0.199	-3.95	6.451	-0.164
II	83224068	0.0	998.99	0.199	-3.99	6.422	-0.162
I	82263032	0.0	999.96	0.201	-6.00	6.652	-0.178
I	82264008	0.0	999.49	0.200	-6.00	6.643	-0.190
I	82264009	0.0	1000.08	0.199	-6.00	6.646	-0.18[illegible]
II	83224069	0.0	998.99	0.201	-5.99	6.422	-0.166
II	83224070	0.0	999.92	0.199	-5.99	6.432	-0.182
II	83224071	0.0	998.76	0.201	-5.99	6.420	-0.171
II	83224072	0.0	999.57	0.198	-5.99	6.432	-0.17[illegible]
I	82263033	0.0	999.62	0.201	-8.00	6.639	-0.195
I	82264010	0.0	1000.78	0.199	-8.00	6.656	-0.205
I	82264011	0.0	1001.25	0.200	-8.00	6.662	-0.206
I	82264012	0.0	999.96	0.200	-8.00	6.648	-0.206
II	83224073	0.0	999.11	0.201	-7.99	6.428	-0.184
II	83224074	0.0	1000.62	0.199	-7.99	6.443	-0.192
II	83224075	0.0	999.69	0.199	-7.99	6.432	-0.182
II	83224076	0.0	999.34	0.196	-7.99	6.432	-0.194
I	82263034	0.0	1001.13	0.202	-10.00	6.666	-0.206
I	82264013	0.0	999.96	0.199	-10.00	6.646	-0.211
I	82264014	0.0	999.26	0.198	-10.00	6.641	-0.211
II	83224077	0.0	998.88	0.199	-10.03	6.424	-0.206
II	83224078	0.0	998.88	0.201	-10.03	6.424	-0.212

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83224079	0.0	999.11	0.199	-10.03	6.428	-0.196
I	82263035	0.0	1001.60	0.203	-12.00	6.674	-0.199
I	82264015	0.0	1000.20	0.198	-12.03	6.648	-0.213
I	82264016	0.0	1000.20	0.200	-12.00	6.648	-0.208
I	82264017	0.0	1001.60	0.199	-12.00	6.666	-0.206
II	83224080	0.0	999.34	0.197	-12.02	6.426	-0.200
II	83224081	0.0	998.53	0.201	-12.02	6.418	-0.202
II	83224082	0.0	999.57	0.201	-12.02	6.432	-0.211
II	83224083	0.0	999.11	0.200	-12.02	6.426	-0.209
I	82263036	0.0	1000.08	0.202	-14.00	6.652	-0.195
I	82264018	0.0	1000.43	0.199	-14.00	6.652	-0.200
I	82264019	0.0	1000.78	0.199	-14.00	6.656	-0.196
I	82264020	0.0	1000.55	0.198	-14.00	6.652	-0.199
II	83224084	0.0	998.99	0.199	-14.00	6.422	-0.199
II	83224085	0.0	998.07	0.197	-14.00	6.412	-0.195
II	83224086	0.0	1000.27	0.198	-14.00	6.440	-0.201
II	83224087	0.0	1000.15	0.199	-14.00	6.438	-0.188
I	82263037	0.0	999.49	0.202	-16.00	6.648	-0.194
I	82264021	0.0	999.96	0.200	-16.00	6.650	-0.205
I	82264022	0.0	1000.08	0.200	-16.00	6.652	-0.192
I	82264023	0.0	1000.43	0.199	-16.00	6.656	-0.201
II	83224088	0.0	999.46	0.199	-16.01	6.432	-0.179
II	83224089	0.0	999.81	0.197	-16.01	6.436	-0.189
II	83224090	0.0	999.57	0.199	-16.01	6.432	-0.199
II	83224091	0.0	999.92	0.200	-16.01	6.438	-0.187
I	82263038	0.0	1000.31	0.200	-18.00	6.666	-0.180
I	82264024	0.0	1001.84	0.197	-18.00	6.682	-0.182
I	82264025	0.0	1000.08	0.199	-18.00	6.658	-0.190
I	82264026	0.0	1001.13	0.200	-18.00	6.670	-0.177
I	82263039	0.0	999.61	0.202	-20.00	6.662	-0.180
I	82264027	0.0	999.73	0.200	-20.00	6.658	-0.172
I	82264028	0.0	1000.66	0.199	-20.00	6.672	-0.195
I	82264029	0.0	1000.43	0.197	-20.00	6.668	-0.197
I	82264030	0.0	1000.08	0.251	0.00	6.650	-0.185
I	82264031	0.0	999.61	0.250	0.00	6.645	-0.188
II	83224094	0.0	999.92	0.250	0.02	6.432	-0.175
II	83224095	0.0	1000.97	0.249	0.02	6.445	-0.181
II	83224096	0.0	1000.04	0.249	0.02	6.434	-0.177
I	82264032	0.0	999.96	0.250	-2.00	6.650	-0.187
I	82264033	0.0	999.84	0.251	-2.00	6.646	-0.180
II	83224097	0.0	1000.97	0.248	-2.06	6.445	-0.177
II	83224098	0.0	999.23	0.249	-2.06	6.426	-0.166
II	83224099	0.0	1000.97	0.249	-2.06	6.445	-0.172
I	82264034	0.0	1001.02	0.250	-4.00	6.660	-0.189
I	82264035	0.0	999.26	0.250	-4.00	6.641	-0.190
II	83224100	0.0	999.92	0.252	-3.99	6.434	-0.160

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83224101	0.0	999.34	0.250	-3.99	6.428	-0.165
II	83224102	0.0	999.57	0.251	-3.99	6.430	-0.171
II	83224103	0.0	1000.04	0.251	-3.99	6.434	-0.164
I	82264036	0.0	999.73	0.250	-6.00	6.648	-0.199
I	82264037	0.0	999.73	0.250	-6.00	6.648	-0.192
I	82264038	0.0	1000.90	0.250	-6.00	6.664	-0.196
II	83224104	0.0	1000.04	0.250	-5.92	6.436	-0.183
II	83224105	0.0	999.11	0.249	-5.92	6.424	-0.185
II	83224106	0.0	999.34	0.251	-5.92	6.428	-0.182
I	82264039	0.0	1000.90	0.250	-8.00	6.666	-0.200
I	82264040	0.0	1001.48	0.249	-8.00	6.672	-0.198
II	83224107	0.0	1000.04	0.251	-8.00	6.436	-0.207
II	83224108	0.0	999.34	0.248	-8.00	6.428	-0.200
II	83224109	0.0	998.65	0.248	-7.99	6.422	-0.202
I	82264041	0.0	1000.55	0.250	-10.00	6.639	-0.201
I	82264042	0.0	999.84	0.254	-10.00	6.639	-0.195
I	82264043	0.0	1000.90	0.252	-12.00	6.639	-0.195
I	82264044	0.0	999.84	0.252	-12.00	6.639	-0.195
I	82264045	0.0	998.32	0.252	-14.00	6.641	-0.182
I	82264046	0.0	999.96	0.252	-14.00	6.662	-0.184
I	82264047	0.0	1000.90	0.250	-16.00	6.639	-0.200
I	82264048	0.0	998.55	0.250	-16.00	6.639	-0.197
I	82264049	0.0	1000.20	0.252	-18.00	6.639	-0.224
I	82264050	0.0	999.38	0.253	-18.00	6.672	-0.231
I	82264051	0.0	1000.66	0.250	-20.00	6.639	-0.229
I	82264052	0.0	1000.90	0.250	-20.00	6.639	-0.216
I	82264053	0.0	999.73	0.301	0.00	6.639	-0.182
I	82264054	0.0	999.14	0.301	0.00	6.639	-0.183
II	83224110	0.0	999.81	0.297	0.02	6.432	-0.187
II	83224111	0.0	998.99	0.299	0.06	6.424	-0.173
II	83224112	0.0	999.46	0.299	0.06	6.426	-0.184
II	83224113	0.0	999.34	0.297	0.06	6.430	-0.180
II	83228005	0.0	1000.62	0.298	0.00	6.443	-0.163
II	83228006	0.0	1000.73	0.297	0.00	6.445	-0.202
II	83228007	0.0	1000.27	0.302	0.00	6.441	-0.176
II	83228008	0.0	999.69	0.298	-0.01	6.434	-0.181
II	83228009	0.0	998.76	0.302	-0.01	6.424	-0.184
II	83228010	0.0	999.46	0.301	-0.01	6.432	-0.195
II	83229004	0.0	1000.15	0.298	-0.04	6.432	-0.182
II	83229005	0.0	1001.20	0.300	-0.04	6.445	-0.176
I	82264055	0.0	999.98	0.300	-2.00	6.639	-0.184
I	82264056	0.0	1000.20	0.301	-2.00	6.639	-0.184
II	83224114	0.0	1000.04	0.301	-2.02	6.436	-0.175
II	83224115	0.0	999.81	0.299	-2.02	6.434	-0.177
II	83224116	0.0	1000.62	0.299	-2.02	6.441	-0.166
II	83224117	0.0	999.92	0.300	-2.02	6.434	-0.172

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83228011	0.0	997.95	0.300	-2.02	6.414	-0.178
II	83228012	0.0	999.34	0.302	-2.02	6.430	-0.171
II	83228013	0.0	999.23	0.299	-2.02	6.430	-0.177
II	83228014	0.0	1000.50	0.301	-2.02	6.445	-0.170
I	82264057	0.0	999.84	0.300	-4.00	6.639	-0.187
I	82264058	0.0	999.38	0.302	-4.00	6.639	-0.185
II	83228015	0.0	1000.50	0.300	-4.01	6.445	-0.163
II	83228016	0.0	999.92	0.299	-4.01	6.440	-0.171
II	83228017	0.0	999.46	0.297	-4.01	6.434	-0.170
II	83228018	0.0	999.46	0.297	-4.01	6.434	-0.160
I	82264059	0.0	1000.08	0.299	-6.00	6.639	-0.204
I	82264060	0.0	1000.20	0.298	-6.00	6.639	-0.201
II	83228019	0.0	998.53	0.298	-5.96	6.424	-0.185
II	83228020	0.0	998.88	0.300	-5.96	6.428	-0.196
II	83228021	0.0	998.99	0.298	-5.96	6.430	-0.190
II	83228022	0.0	998.41	0.300	-5.96	6.422	-0.199
II	83228023	0.0	1000.04	0.297	-5.96	6.440	-0.193
I	82264061	0.0	1000.08	0.299	-8.00	6.639	-0.196
I	82264062	0.0	1000.43	0.299	-8.00	6.639	-0.202
II	83228024	0.0	1000.73	0.300	-7.99	6.449	-0.203
II	83228025	0.0	1000.73	0.297	-7.99	6.445	-0.207
II	83228026	0.0	1001.43	0.299	-7.99	6.457	-0.202
II	83228027	0.0	1000.85	0.300	-7.99	6.451	-0.197
I	82264063	0.0	1001.13	0.299	-10.00	6.639	-0.185
I	82264064	0.0	1000.43	0.299	-10.00	6.639	-0.191
I	82264065	0.0	1001.37	0.300	-12.00	6.639	-0.189
I	82264066	0.0	1001.84	0.299	-12.00	6.639	-0.193
I	82264067	0.0	999.96	0.300	-14.00	6.639	-0.244
I	82264068	0.0	999.38	0.299	-14.00	6.639	-0.242
I	82264069	0.0	999.84	0.301	-16.00	6.684	-0.308
I	82264070	0.0	1000.43	0.299	-16.00	6.639	-0.277
I	82264071	0.0	1000.20	0.297	-16.00	6.639	-0.274
I	82264072	0.0	1001.13	0.299	-18.00	6.639	-0.293
I	82264073	0.0	1001.60	0.295	-18.00	6.639	-0.293
I	82264074	0.0	999.84	0.299	-20.00	6.639	-0.326
I	82264075	0.0	999.96	0.301	-20.00	6.639	-0.348
I	82264076	0.0	1000.08	0.350	0.00	6.639	-0.215
I	82264077	0.0	1000.43	0.348	0.00	6.639	-0.181
I	82264078	0.0	1001.48	0.350	0.00	6.639	-0.212
I	82264079	0.0	1000.08	0.353	0.00	6.639	-0.194
II	83229006	0.0	999.46	0.346	-0.01	6.424	-0.195
II	83229007	0.0	999.69	0.350	-0.01	6.428	-0.197
II	83229008	0.0	999.57	0.350	-0.02	6.426	-0.183
II	83229009	0.0	998.88	0.349	-0.02	6.418	-0.194
I	82264080	0.0	999.84	0.351	-2.00	6.639	-0.189
I	82264081	0.0	998.32	0.352	-2.00	6.635	-0.188

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83229010	0.0	999.23	0.350	-1.99	6.424	-0.187
II	83229011	0.0	999.23	0.351	-1.99	6.422	-0.183
II	83229012	0.0	1000.27	0.350	-1.99	6.434	-0.180
II	83229013	0.0	1000.04	0.349	-1.99	6.434	-0.184
I	82264082	0.0	998.67	0.351	-4.00	6.637	-0.185
I	82264083	0.0	1000.31	0.349	-4.00	6.639	-0.190
II	83229014	0.0	999.34	0.352	-4.02	6.424	-0.183
II	83229015	0.0	999.69	0.349	-4.03	6.430	-0.175
II	83229016	0.0	999.11	0.348	-4.03	6.422	-0.184
II	83229017	0.0	1001.90	0.347	-4.03	6.455	-0.186
I	82264084	0.0	1000.43	0.349	-6.00	6.639	-0.203
I	82264085	0.0	999.84	0.351	-6.00	6.639	-0.202
II	83229018	0.0	998.65	0.349	-5.98	6.416	-0.193
II	83229019	0.0	999.69	0.351	-5.98	6.424	-0.192
II	83229020	0.0	999.69	0.349	-5.98	6.428	-0.203
II	83229021	0.0	998.99	0.351	-5.98	6.422	-0.211
I	82264086	0.0	1000.43	0.351	-8.00	6.639	-0.209
I	82264087	0.0	1000.20	0.350	-8.00	6.639	-0.209
I	82264088	0.0	1000.55	0.351	-10.00	6.639	-0.225
I	82264089	0.0	1000.08	0.352	-10.00	6.639	-0.237
I	82265001	0.0	1000.90	0.349	-10.00	6.639	-0.219
I	82265002	0.0	1001.25	0.348	-10.00	6.639	-0.220
I	82265003	0.0	1000.08	0.349	-12.00	6.639	-0.325
I	82265004	0.0	999.84	0.350	-12.00	6.639	-0.327
I	82265005	0.0	999.49	0.350	-14.00	6.639	-0.375
I	82265006	0.0	1000.66	0.349	-14.00	6.686	-0.347
I	82265007	0.0	1000.55	0.351	-16.00	6.695	-0.398
I	82265008	0.0	1000.43	0.350	-16.00	6.691	-0.413
I	82265009	0.0	1000.20	0.350	-16.00	6.689	-0.363
I	82265010	0.0	1000.90	0.350	-16.00	6.701	-0.383
I	82265011	0.0	999.96	0.350	-18.00	6.695	-0.435
I	82265012	0.0	1000.20	0.350	-18.00	6.711	-0.440
I	82265013	0.0	1000.43	0.348	-20.00	6.721	-0.494
I	82265014	0.0	1002.30	0.348	-20.00	6.740	-0.436
I	82265015	0.0	1000.20	0.400	0.00	6.645	-0.195
I	82265016	0.0	999.73	0.399	0.00	6.639	-0.230
I	82265017	0.0	1000.55	0.400	0.00	6.652	-0.217
II	83229022	0.0	999.11	0.397	0.00	6.420	-0.204
II	83229023	0.0	999.46	0.396	0.00	6.424	-0.196
II	83229024	0.0	1000.85	0.397	0.00	6.441	-0.204
II	83229025	0.0	1001.55	0.398	0.00	6.451	-0.202
I	82265018	0.0	999.02	0.401	-2.00	6.637	-0.208
I	82265019	0.0	999.49	0.403	-2.00	6.643	-0.223
II	83229026	0.0	998.65	0.401	-1.99	6.418	-0.206
II	83229027	0.0	998.18	0.400	-1.99	6.412	-0.187
II	83229028	0.0	999.46	0.400	-1.99	6.428	-0.194

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83229029	0.0	1000.04	0.398	-1.99	6.436	-0.207
I	82265020	0.0	1001.72	0.399	-4.00	6.670	-0.208
I	82265021	0.0	1000.43	0.400	-4.00	6.654	-0.198
II	83229030	0.0	1000.15	0.402	-3.99	6.438	-0.185
II	83229031	0.0	1000.04	0.401	-3.99	6.436	-0.203
II	83229032	0.0	1000.15	0.401	-4.00	6.438	-0.183
II	83229033	0.0	1000.27	0.396	-4.00	6.440	-0.191
I	82265022	0.0	999.38	0.401	-6.00	6.643	-0.213
I	82265023	0.0	1000.08	0.400	-6.00	6.648	-0.214
I	82265024	0.0	999.02	0.402	-8.00	6.641	-0.218
I	82265025	0.0	999.38	0.401	-8.00	6.645	-0.219
I	82265026	0.0	998.55	0.402	-10.00	6.643	-0.313
I	82265027	0.0	998.91	0.403	-10.00	6.650	-0.318
I	82265028	0.0	1000.66	0.402	-12.00	6.682	-0.392
I	82265029	0.0	1000.90	0.402	-12.00	6.688	-0.374
I	82265030	0.0	1000.31	0.401	-14.00	6.701	-0.358
I	82265031	0.0	999.26	0.399	-14.00	6.688	-0.462
I	82265032	0.0	1001.37	0.400	-14.00	6.717	-0.474
I	82265034	0.0	999.73	0.396	-16.00	6.705	-0.471
I	82265035	0.0	1000.43	0.450	0.00	6.658	-0.237
I	82265036	0.0	999.49	0.451	0.00	6.646	-0.236
II	83229035	0.0	999.57	0.449	0.01	6.430	-0.221
II	83229036	0.0	999.69	0.448	0.00	6.430	-0.243
II	83229037	0.0	999.69	0.447	0.00	6.434	-0.216
I	82265037	0.0	1000.08	0.450	-2.00	6.654	-0.217
I	82265038	0.0	999.61	0.446	-2.00	6.650	-0.214
I	82265039	0.0	1000.08	0.450	-2.00	6.656	-0.209
I	82265040	0.0	999.73	0.451	-2.00	6.652	-0.227
II	83229038	0.0	999.69	0.449	-1.97	6.432	-0.212
II	83229039	0.0	1000.04	0.451	-1.97	6.438	-0.199
II	83229040	0.0	998.99	0.449	-1.98	6.426	-0.201
I	82265041	0.0	1000.66	0.452	-4.00	6.666	-0.205
I	82265042	0.0	999.61	0.450	-4.00	6.654	-0.201
II	83229042	0.0	999.57	0.451	-4.04	6.428	-0.194
II	83229043	0.0	999.57	0.453	-4.04	6.430	-0.195
II	83229044	0.0	1000.39	0.448	-4.04	6.441	-0.191
II	83229045	0.0	999.92	0.449	-4.04	6.434	-0.199
I	82265043	0.0	1000.55	0.450	-6.00	6.658	-0.200
I	82265044	0.0	1000.20	0.449	-6.00	6.656	-0.208
I	82265045	0.0	1000.78	0.453	-8.00	6.674	-0.261
I	82265046	0.0	999.49	0.451	-8.00	6.656	-0.272
I	82265047	0.0	1000.08	0.447	-10.00	6.678	-0.417
I	82265048	0.0	1000.55	0.449	-10.00	6.689	-0.463
I	82265049	0.0	1000.43	0.450	-12.00	6.699	-0.426
I	82265050	0.0	1000.43	0.450	-12.00	6.699	-0.488
I	82265051	0.0	998.44	0.451	-14.00	6.695	-0.477

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
I	82265052	0.0	1000.78	0.450	-14.00	6.725	-0.598
I	82265053	0.0	1000.78	0.499	0.00	6.668	-0.242
I	82265054	0.0	1000.66	0.500	0.00	6.664	-0.246
I	82265055	0.0	999.49	0.502	-2.00	6.654	-0.217
I	82265056	0.0	1000.20	0.501	-2.00	6.662	-0.244
I	82265057	0.0	999.14	0.505	-4.00	6.648	-0.210
I	82265058	0.0	999.14	0.503	-4.00	6.648	-0.199
I	82265059	0.0	999.98	0.500	-6.00	6.654	-0.235
I	82265060	0.0	1000.31	0.503	-6.00	6.658	-0.249
I	82265061	0.0	1000.66	0.503	-8.00	6.676	-0.394
I	82265062	0.0	999.96	0.501	-8.00	6.664	-0.406
I	82265063	0.0	999.61	0.500	-10.00	6.676	-0.528
I	82265064	0.0	999.38	0.500	-10.00	6.676	-0.581
I	82265065	0.0	1000.08	0.500	-12.00	6.697	-0.720
I	82265066	0.0	1000.90	0.499	-12.00	6.717	-0.566
I	82265067	0.0	1001.48	0.549	0.00	6.680	-0.241
I	82265068	0.0	1001.37	0.550	0.00	6.674	-0.246
I	82265069	0.0	999.61	0.552	-2.00	6.652	-0.220
I	82265070	0.0	999.84	0.550	-2.00	6.658	-0.234
I	82265071	0.0	999.14	0.551	-4.00	6.646	-0.194
I	82265072	0.0	999.84	0.550	-4.00	6.654	-0.206
I	82265073	0.0	999.84	0.554	-6.00	6.656	-0.326
I	82265074	0.0	998.67	0.557	-6.00	6.639	-0.355
I	82265075	0.0	1001.37	0.551	-8.00	6.688	-0.444
I	82265076	0.0	1000.43	0.550	-8.00	6.674	-0.464
I	82265077	0.0	1000.43	0.553	-10.00	6.699	-0.620
I	82265078	0.0	1000.78	0.553	-10.00	6.689	-0.620
II	83244038	3.0	999.23	0.042	0.06	6.430	-0.309
II	83244039	3.0	999.57	0.042	0.10	6.434	-0.308
II	83245002	3.0	1002.01	0.042	0.00	6.455	-0.303
II	83249004	3.0	1001.08	0.045	-0.06	6.445	-0.306
II	83249005	3.0	998.76	0.047	-0.06	6.418	-0.304
II	83249006	3.0	1000.27	0.047	-0.01	6.436	-0.311
II	83250008	3.0	999.81	0.044	0.00	6.436	-0.301
II	83250009	3.0	1000.04	0.043	-0.04	6.438	-0.309
II	83250010	3.0	998.88	0.043	-0.01	6.424	-0.307
II	83250011	3.0	1000.27	0.042	-0.02	6.441	-0.301
II	83244040	3.0	999.81	0.045	-2.06	6.436	-0.306
II	83244041	3.0	1000.62	0.046	-2.06	6.445	-0.309
II	83249007	3.0	1001.08	0.048	-2.05	6.445	-0.313
II	83249008	3.0	999.69	0.048	-2.05	6.430	-0.305
II	83249009	3.0	999.81	0.048	-2.05	6.430	-0.303
II	83249010	3.0	1000.97	0.048	-2.05	6.445	-0.303
II	83250012	3.0	999.69	0.045	-1.99	6.434	-0.307
II	83250013	3.0	1000.39	0.045	-1.96	6.441	-0.310
II	83244042	3.0	999.92	0.046	-3.98	6.438	-0.303

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83244043	3.0	998.88	0.046	-3.98	6.426	-0.304
II	83245003	3.0	1000.15	0.045	-3.97	6.432	-0.305
II	83249011	3.0	998.76	0.048	-4.01	6.418	-0.304
II	83249012	3.0	999.34	0.049	-4.01	6.426	-0.308
II	83249013	3.0	1001.08	0.048	-4.01	6.445	-0.303
II	83250014	3.0	999.81	0.046	-4.02	6.434	-0.298
II	83250015	3.0	998.99	0.045	-4.02	6.424	-0.304
II	83244044	3.0	999.11	0.045	-6.06	6.426	-0.305
II	83244045	3.0	998.07	0.046	-6.06	6.414	-0.308
II	83244046	3.0	1000.27	0.046	-6.06	6.441	-0.307
II	83249014	3.0	999.23	0.048	-6.06	6.424	-0.303
II	83249016	3.0	1001.08	0.047	-6.06	6.445	-0.306
II	83249017	3.0	999.34	0.047	-6.06	6.426	-0.307
II	83250016	3.0	999.57	0.045	-6.03	6.432	-0.300
II	83250017	3.0	998.76	0.044	-6.03	6.422	-0.302
II	83244047	3.0	1000.15	0.046	-8.06	6.440	-0.306
II	83245004	3.0	999.46	0.045	-7.98	6.424	-0.304
II	83249018	3.0	1000.85	0.048	-8.02	6.441	-0.301
II	83249020	3.0	999.92	0.047	-8.02	6.434	-0.307
II	83249021	3.0	999.69	0.047	-7.99	6.430	-0.301
II	83250019	3.0	999.34	0.043	-8.06	6.430	-0.300
II	83250020	3.0	1000.27	0.045	-8.05	6.440	-0.302
II	83244049	3.0	999.92	0.043	-10.04	6.438	-0.301
II	83244050	3.0	1000.15	0.044	-10.06	6.440	-0.300
II	83245005	3.0	1000.62	0.044	-10.01	6.438	-0.305
II	83245006	3.0	1000.15	0.042	-10.01	6.432	-0.300
II	83245007	3.0	999.69	0.046	-9.95	6.426	-0.299
II	83250022	3.0	999.81	0.046	-10.00	6.434	-0.293
II	83250023	3.0	1001.20	0.045	-10.00	6.449	-0.295
II	83250024	3.0	1000.62	0.044	-11.96	6.441	-0.289
II	83250025	3.0	999.34	0.043	-11.96	6.428	-0.288
II	83250026	3.0	999.69	0.042	-14.00	6.432	-0.295
II	83250027	3.0	999.34	0.044	-14.00	6.428	-0.289
II	83250028	3.0	1000.04	0.043	-16.04	6.436	-0.297
II	83250029	3.0	999.34	0.044	-16.04	6.426	-0.291
II	83250030	3.0	999.23	0.044	-17.99	6.426	-0.295
II	83250031	3.0	998.53	0.043	-17.99	6.418	-0.288
II	83250032	3.0	1000.73	0.044	-20.00	6.443	-0.286
II	83250033	3.0	1001.20	0.045	-20.00	6.449	-0.285
II	83250034	3.0	1000.04	0.097	0.06	6.443	-0.294
II	83250035	3.0	1000.50	0.096	0.05	6.447	-0.294
II	83250036	3.0	1000.73	0.098	-2.07	6.451	-0.302
II	83250037	3.0	998.76	0.099	-2.07	6.426	-0.298
II	83250038	3.0	998.53	0.098	-3.96	6.426	-0.293
II	83250039	3.0	1001.08	0.097	-3.96	6.451	-0.293
II	83250040	3.0	1000.50	0.098	-5.97	6.445	-0.291

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83250041	3.0	999.46	0.099	-5.96	6.434	-0.289
II	83250042	3.0	999.46	0.099	-7.96	6.434	-0.291
II	83250043	3.0	999.92	0.097	-7.94	6.438	-0.294
II	83250044	3.0	999.46	0.097	-9.97	6.432	-0.294
II	83250045	3.0	1000.39	0.097	-9.96	6.441	-0.294
II	83250046	3.0	999.92	0.098	-12.08	6.436	-0.286
II	83250047	3.0	999.57	0.099	-12.07	6.434	-0.291
II	83250048	3.0	1000.04	0.099	-14.04	6.438	-0.288
II	83250049	3.0	1000.50	0.098	-14.03	6.443	-0.290
II	83250050	3.0	1000.39	0.099	-16.04	6.441	-0.286
II	83250051	3.0	998.99	0.099	-16.04	6.424	-0.287
II	83250052	3.0	999.11	0.097	-17.98	6.426	-0.280
II	83250053	3.0	999.57	0.094	-17.98	6.428	-0.278
II	83250054	3.0	998.65	0.096	-20.00	6.416	-0.282
II	83250055	3.0	1000.39	0.099	-20.00	6.438	-0.282
II	83251004	3.0	999.92	0.149	-4.05	6.434	-0.301
II	83251005	3.0	998.88	0.149	-4.05	6.422	-0.296
II	83251006	3.0	1000.04	0.146	-6.05	6.434	-0.296
II	83251007	3.0	1000.27	0.148	-6.05	6.436	-0.297
II	83251008	3.0	999.11	0.149	-8.02	6.422	-0.292
II	83251009	3.0	999.34	0.149	-8.02	6.424	-0.293
II	83251010	3.0	1000.62	0.149	-9.99	6.438	-0.291
II	83251011	3.0	1001.20	0.147	-9.99	6.443	-0.288
II	83251012	3.0	1000.50	0.149	-12.06	6.436	-0.286
II	83251013	3.0	1000.27	0.147	-12.06	6.434	-0.279
II	83251014	3.0	999.11	0.147	-13.96	6.416	-0.285
II	83251015	3.0	999.57	0.149	-13.95	6.422	-0.288
II	83251016	3.0	1000.04	0.148	-16.03	6.426	-0.280
II	83251017	3.0	999.11	0.148	-16.03	6.416	-0.282
II	83251018	3.0	999.92	0.148	-17.96	6.424	-0.281
II	83251019	3.0	1000.50	0.149	-17.96	6.430	-0.273
II	83251020	3.0	1000.27	0.149	-19.95	6.426	-0.271
II	83251021	3.0	999.57	0.148	-19.95	6.420	-0.266
II	83251026	3.0	1000.50	0.200	-7.95	6.440	-0.296
II	83251027	3.0	999.11	0.199	-7.95	6.424	-0.289
II	83251032	3.0	999.46	0.200	-8.00	6.432	-0.284
II	83251033	3.0	1001.43	0.201	-8.01	6.455	-0.295
II	83251034	3.0	999.34	0.199	-8.01	6.430	-0.286
II	83252004	3.0	1000.39	0.198	-7.94	6.436	-0.289
II	83252005	3.0	999.81	0.199	-8.06	6.430	-0.295
II	83252006	3.0	999.92	0.199	-8.06	6.432	-0.293
II	83251035	3.0	1000.39	0.202	-10.01	6.440	-0.278
II	83251036	3.0	999.92	0.198	-10.01	6.436	-0.290
II	83251037	3.0	999.69	0.198	-10.01	6.434	-0.283
II	83252007	3.0	999.69	0.199	-10.02	6.428	-0.296
II	83252008	3.0	999.11	0.199	-10.02	6.416	-0.286

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83252009	3.0	999.57	0.200	-10.02	6.424	-0.283
II	83251038	3.0	999.57	0.200	-11.99	6.426	-0.284
II	83251039	3.0	1000.85	0.199	-11.99	6.443	-0.274
II	83251040	3.0	1000.73	0.200	-11.99	6.443	-0.285
II	83252010	3.0	999.57	0.199	-12.05	6.424	-0.280
II	83252011	3.0	1000.04	0.198	-12.03	6.426	-0.268
II	83252012	3.0	1000.27	0.197	-12.04	6.430	-0.273
II	83252013	3.0	1001.20	0.197	-13.96	6.441	-0.278
II	83252014	3.0	1001.32	0.197	-13.96	6.441	-0.278
II	83252015	3.0	1001.32	0.196	-13.96	6.441	-0.272
II	83252016	3.0	1000.27	0.198	-16.00	6.430	-0.262
II	83252017	3.0	1001.32	0.199	-16.00	6.441	-0.263
II	83252018	3.0	1001.08	0.198	-16.00	6.438	-0.252
II	83252019	3.0	1000.97	0.197	-18.01	6.440	-0.228
II	83252020	3.0	1000.15	0.201	-18.00	6.432	-0.239
II	83252021	3.0	1000.39	0.199	-18.01	6.434	-0.230
II	83252022	3.0	1000.39	0.198	-18.01	6.436	-0.233
II	83252023	3.0	1000.39	0.199	-20.00	6.438	-0.228
II	83252024	3.0	1000.73	0.198	-20.00	6.440	-0.234
II	83252025	3.0	1000.62	0.198	-20.00	6.440	-0.227
II	83252026	3.0	1000.04	0.248	-8.07	6.434	-0.284
II	83252027	3.0	1000.62	0.249	-8.00	6.443	-0.289
II	83252028	3.0	999.92	0.250	-8.00	6.434	-0.297
II	83252029	3.0	998.76	0.249	-10.03	6.416	-0.275
II	83252030	3.0	1000.00	0.250	-10.00	6.426	-0.279
II	83252031	3.0	1000.00	0.250	-10.00	6.433	-0.284
II	83252032	3.0	1000.00	0.250	-12.00	6.432	-0.272
II	83252033	3.0	1000.00	0.250	-12.00	6.426	-0.280
II	83252034	3.0	1000.00	0.250	-12.00	6.430	-0.273
II	83252035	3.0	1000.00	0.250	-14.00	6.440	-0.251
II	83252036	3.0	1000.00	0.250	-14.00	6.434	-0.245
II	83252037	3.0	1000.00	0.250	-14.00	6.424	-0.249
II	83252038	3.0	1000.00	0.250	-16.00	6.434	-0.218
II	83252039	3.0	1000.00	0.250	-16.00	6.440	-0.226
II	83252040	3.0	1000.00	0.250	-16.00	6.430	-0.226
II	83252041	3.0	1000.00	0.250	-18.00	6.434	-0.229
II	83252042	3.0	1000.00	0.250	-18.00	6.440	-0.230
II	83252043	3.0	1000.00	0.250	-18.00	6.447	-0.238
II	83252044	3.0	1000.00	0.250	-20.00	6.441	-0.229
II	83252045	3.0	1000.00	0.250	-20.00	6.443	-0.233
II	83252046	3.0	1000.00	0.250	-20.00	6.434	-0.231
II	83252047	3.0	1000.00	0.300	-10.00	6.418	-0.260
II	83252048	3.0	1000.00	0.300	-10.00	6.420	-0.270
II	83252049	3.0	1000.00	0.300	-10.00	6.422	-0.270
II	83252056	3.0	1000.00	0.300	-10.00	6.424	-0.268
II	83252050	3.0	1000.00	0.300	-12.00	6.436	-0.239

TABLE 11.—CONTINUED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83252051	3.0	1000.00	0.300	-12.00	6.434	-0.235
II	83252052	3.0	1000.00	0.300	-12.00	6.441	-0.236
II	83252057	3.0	1000.00	0.300	-12.00	6.420	-0.239
II	83252053	3.0	1000.00	0.300	-14.00	6.426	-0.220
II	83252058	3.0	1000.00	0.300	-14.00	6.440	-0.214
II	83252058	3.0	1000.00	0.300	-14.00	6.426	-0.270
II	83252059	3.0	1000.00	0.300	-14.00	6.438	-0.213
II	83252060	3.0	1000.00	0.300	-14.00	6.436	-0.211
II	83252061	3.0	1000.00	0.300	-16.00	6.434	-0.227
II	83252062	3.0	1000.00	0.300	-16.00	6.434	-0.208
II	83252063	3.0	1000.00	0.300	-16.00	6.422	-0.215
II	83252064	3.0	1000.00	0.300	-18.00	6.441	-0.205
II	83252065	3.0	1000.00	0.300	-18.00	6.441	-0.194
II	83252066	3.0	1000.00	0.300	-18.00	6.441	-0.204
II	83252067	3.0	1000.00	0.350	-10.00	6.422	-0.247
II	83252068	3.0	1000.00	0.350	-10.00	6.432	-0.246
II	83252070	3.0	1000.00	0.350	-10.00	6.430	-0.249
II	83252071	3.0	1000.00	0.350	-12.00	6.434	-0.202
II	83252072	3.0	1000.00	0.350	-12.00	6.432	-0.212
II	83252073	3.0	1000.00	0.350	-12.00	6.441	-0.202
II	83252074	3.0	1000.00	0.350	-14.00	6.438	-0.190
II	83252075	3.0	1000.00	0.350	-14.00	6.428	-0.199
II	83252076	3.0	1000.00	0.350	-14.00	6.430	-0.194
II	83252077	3.0	1000.00	0.350	-16.00	6.432	-0.172
II	83252078	3.0	1000.00	0.350	-16.00	6.432	-0.179
II	83252079	3.0	1000.00	0.350	-16.00	6.438	-0.173
II	83259051	6.0	999.11	0.046	-2.00	6.453	-0.692
II	83259052	6.0	1000.04	0.041	-2.00	6.461	-0.663
II	83259053	6.0	999.57	0.044	-4.03	6.457	-0.688
II	83259054	6.0	998.88	0.046	-4.02	6.447	-0.692
II	83259055	6.0	999.57	0.047	-6.04	6.451	-0.686
II	83259056	6.0	1001.43	0.041	-6.04	6.478	-0.717
II	83259057	6.0	1000.15	0.046	-7.97	6.465	-0.714
II	83259058	6.0	999.69	0.043	-7.96	6.459	-0.703
II	83259059	6.0	999.34	0.042	-10.00	6.455	-0.685
II	83259060	6.0	998.41	0.044	-10.00	6.443	-0.693
II	83259061	6.0	999.81	0.043	-12.00	6.455	-0.662
II	83259063	6.0	1000.39	0.045	-13.97	6.463	-0.676
II	83259064	6.0	999.34	0.045	-13.96	6.449	-0.667
II	83259065	6.0	999.92	0.044	-16.00	6.457	-0.700
II	83259066	6.0	999.57	0.045	-16.00	6.453	-0.686
II	83259067	6.0	999.11	0.046	-18.05	6.447	-0.710
II	83259068	6.0	998.76	0.046	-18.05	6.441	-0.716
II	83259069	6.0	998.65	0.045	-20.00	6.441	-0.720
II	83259070	6.0	999.81	0.043	-20.00	6.457	-0.724
II	83259071	6.0	997.95	0.093	-16.04	6.436	-0.683

TABLE 11.—CONCLUDED

Rotor tested	Data point number	Collective pitch, deg	Rotor speed, rpm	Advance ratio	Shaft angle, deg	Frequency, Hz	Damping, 1/sec
II	83259072	6.0	998.99	0.095	-16.04	6.445	-0.663
II	83259073	6.0	998.30	0.096	-18.07	6.440	-0.670
II	83259074	6.0	999.81	0.097	-18.07	6.459	-0.668
II	83259075	6.0	998.76	0.097	-20.00	6.445	-0.678
II	83259076	6.0	998.41	0.097	-20.00	6.438	-0.674
II	83259077	6.0	1000.39	0.151	-17.98	6.463	-0.675
II	83259078	6.0	1000.27	0.148	-17.99	6.461	-0.674
II	83259079	6.0	999.57	0.147	-20.00	6.453	-0.689
II	83259080	6.0	999.69	0.149	-20.00	6.453	-0.684

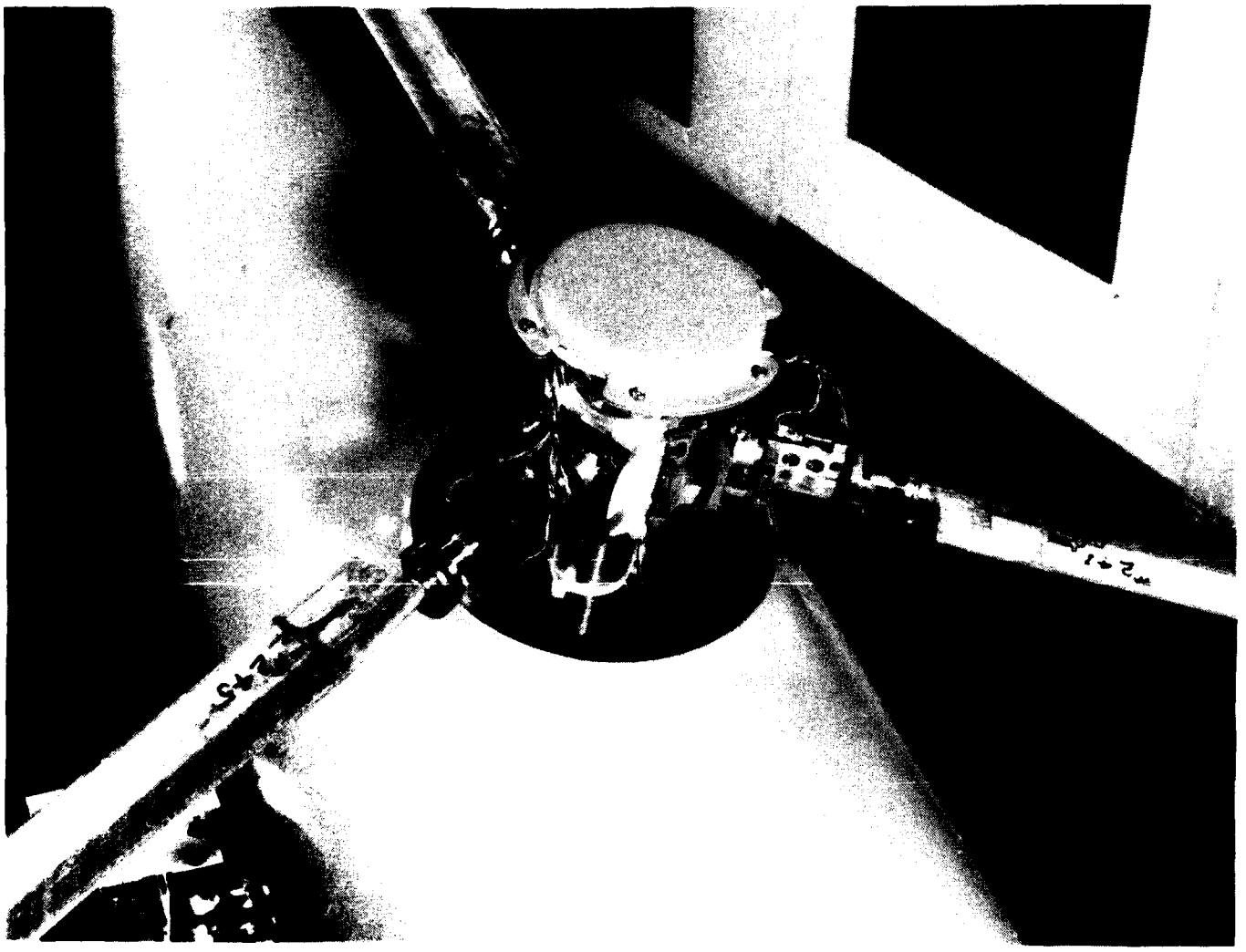


Figure 1.–Model hub and blades.

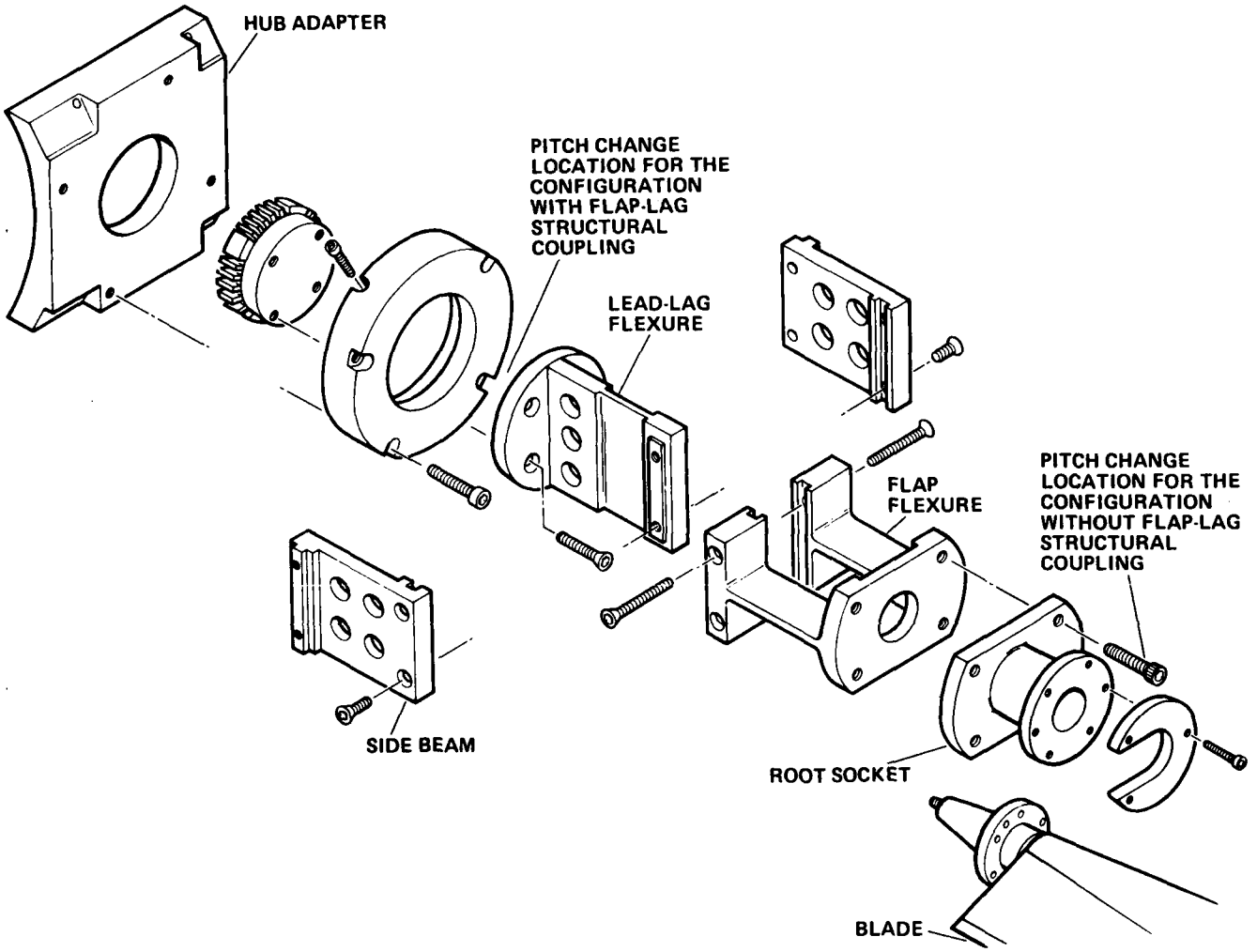


Figure 2.–Exploded view of blade and flexure assembly.

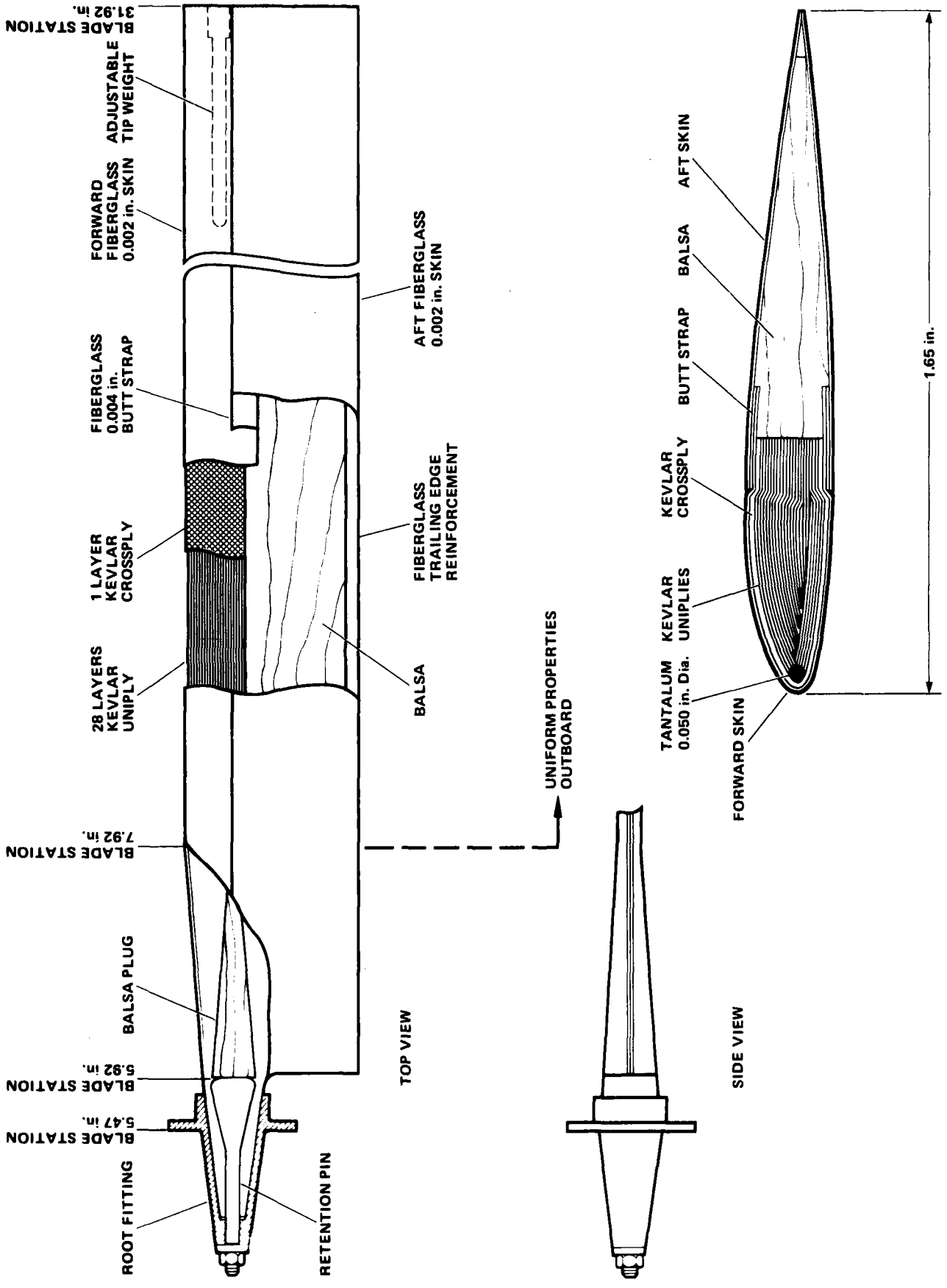


Figure 3.–Rotor blade planform and cross section.

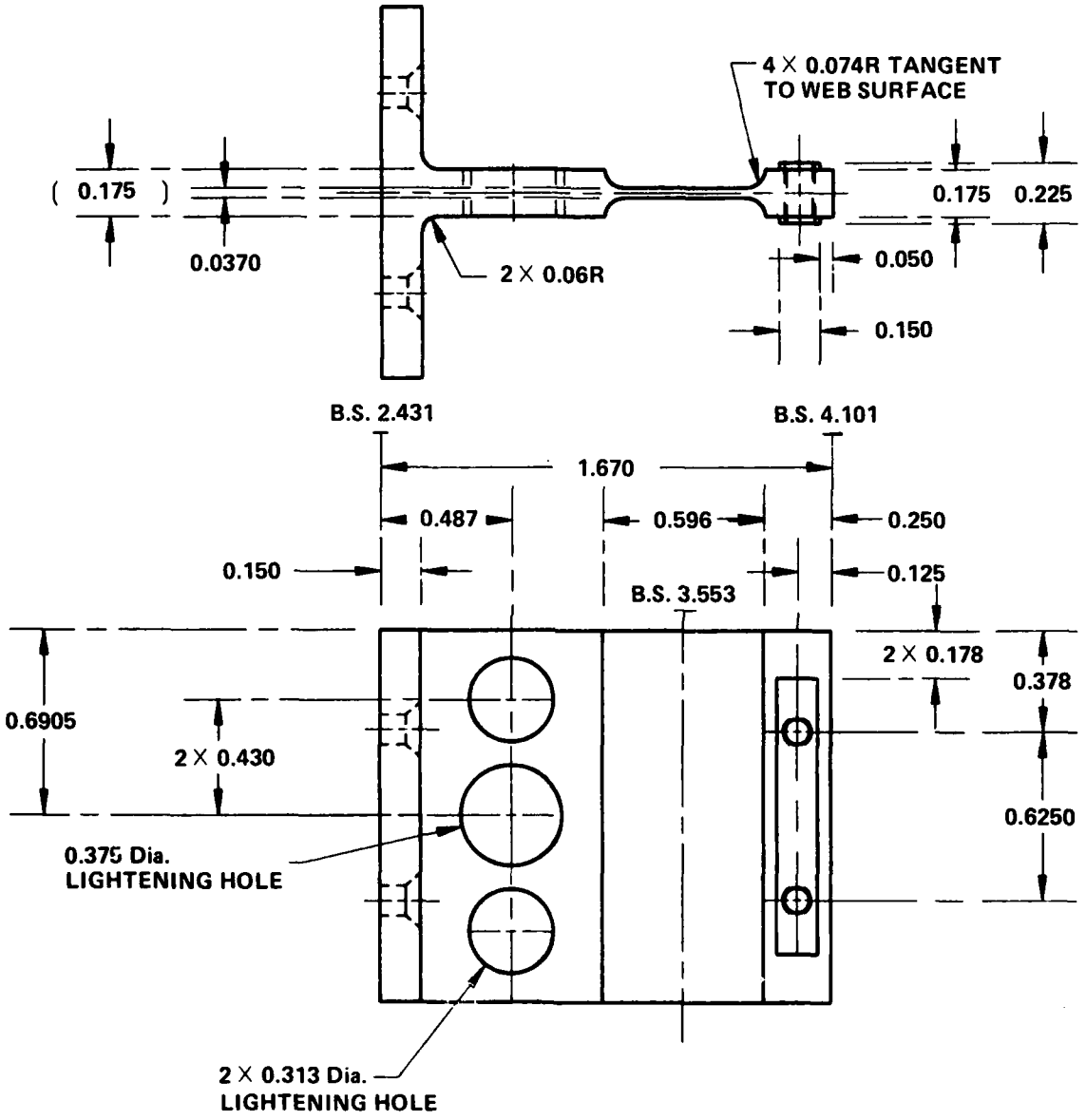


Figure 4.–Lead-lag flexure; 17-4PH H900 steel; dimensions in inches.

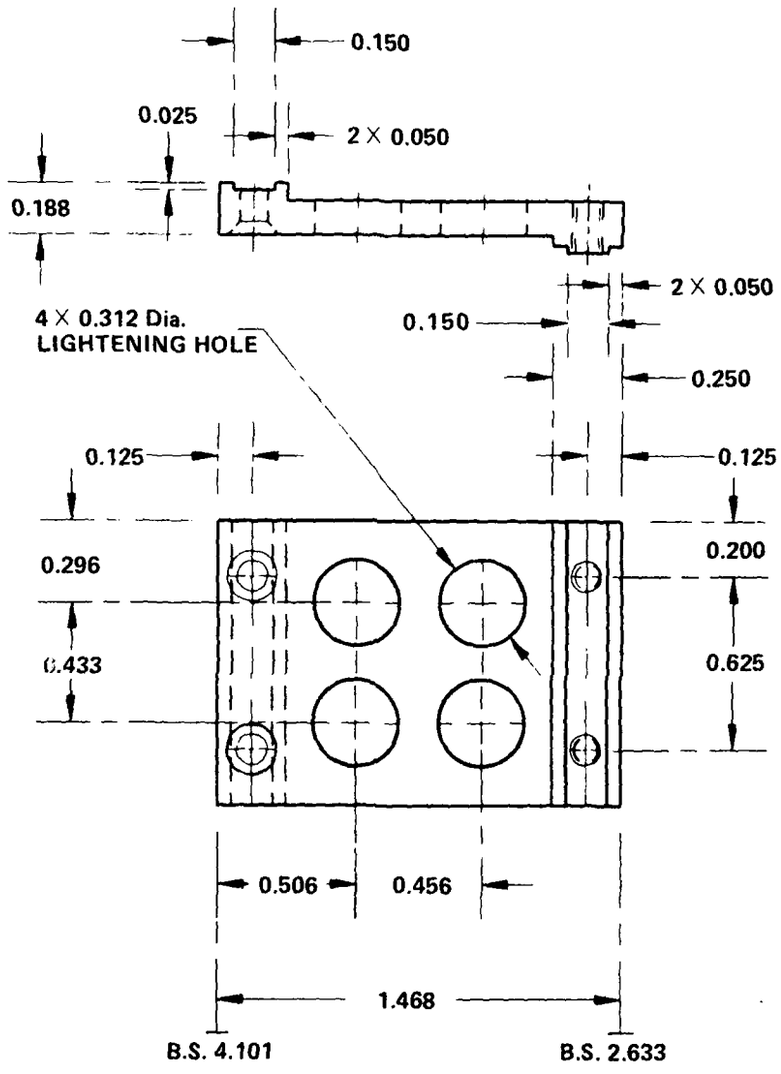


Figure 5.–Side beam; TI-6AL-4V titanium; dimensions in inches.

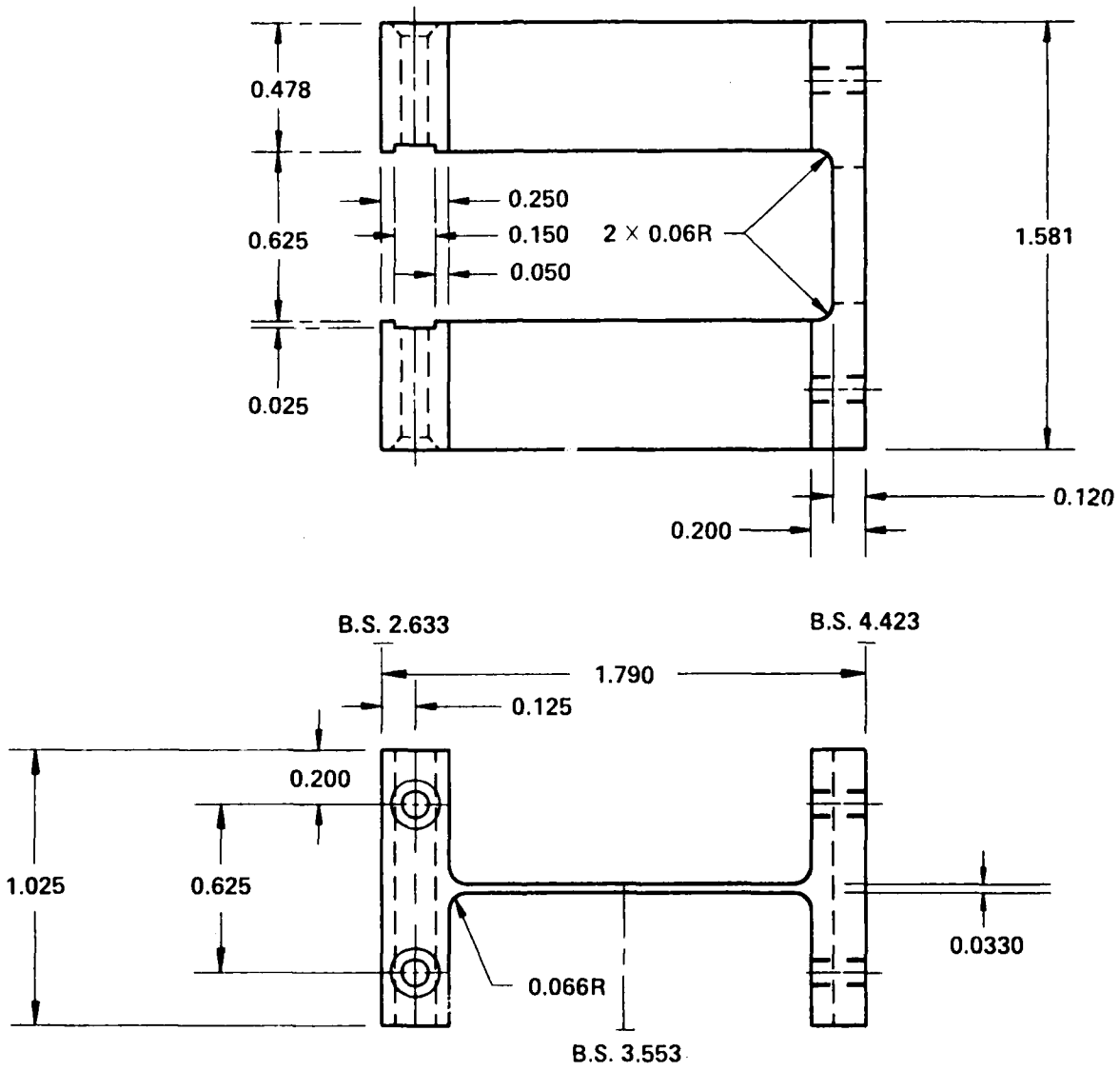


Figure 6.–Flap flexure; 17-4PH H900 steel; dimensions in inches.

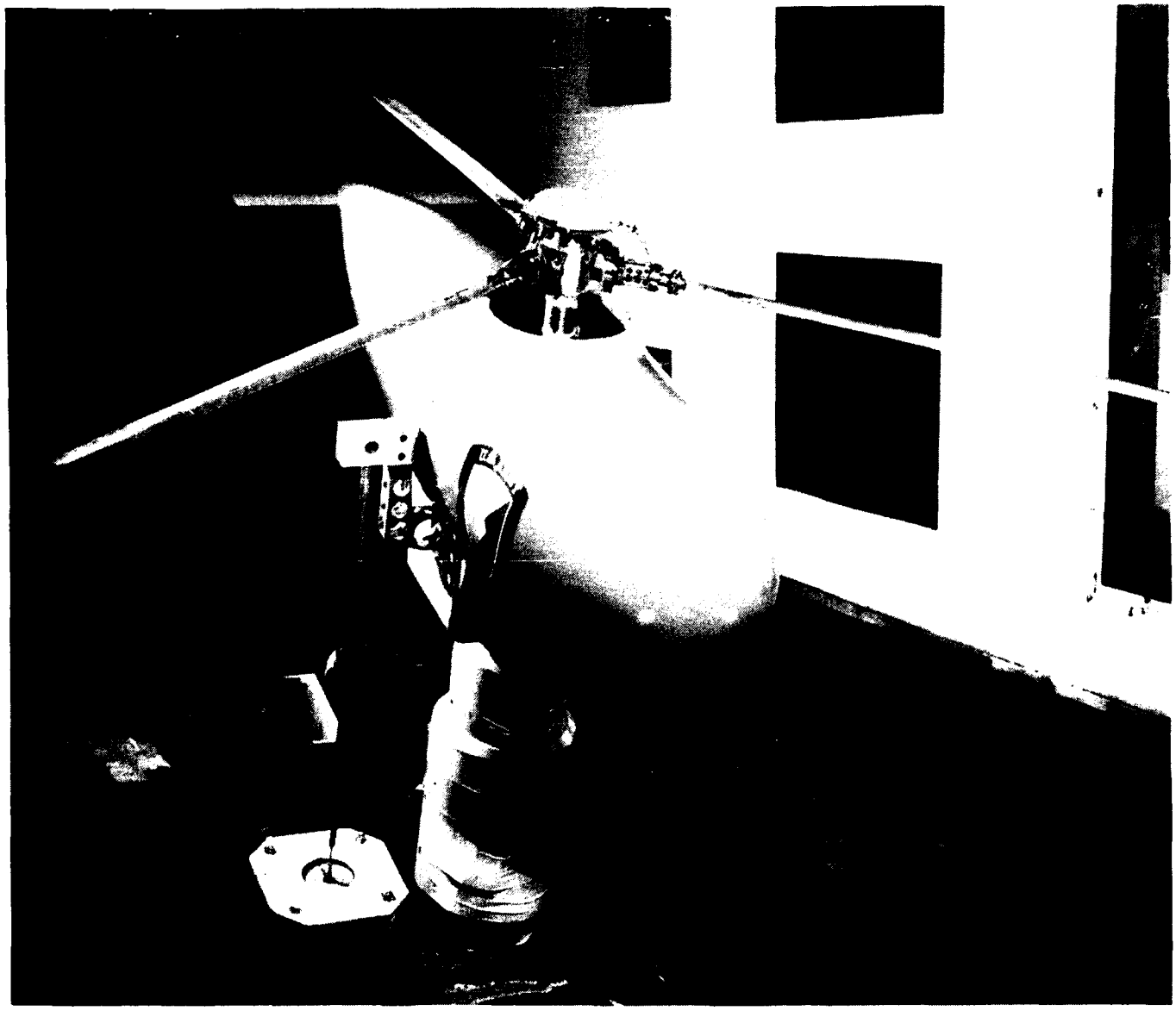
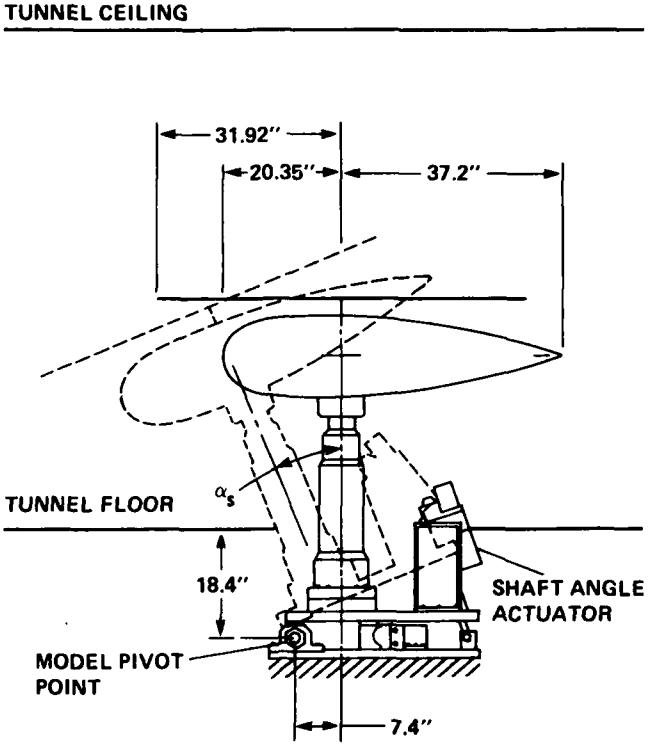
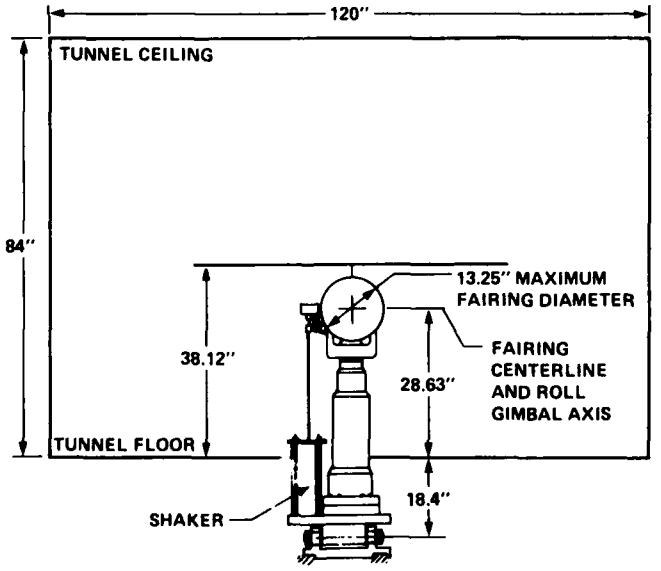


Figure 7.–Model installed in the Aeroflightdynamics Directorate's 7– by 10–foot wind tunnel test section.

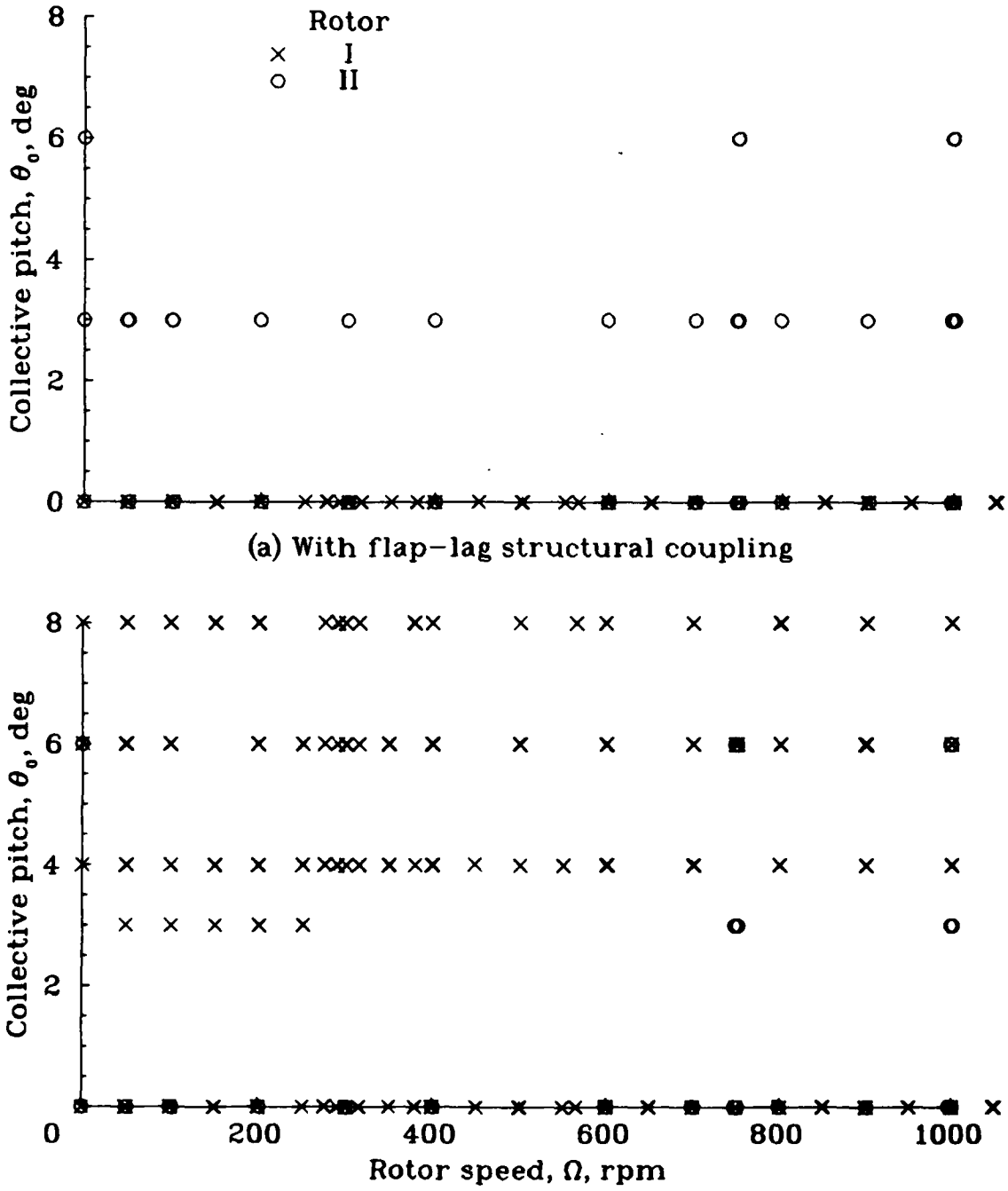


(a) Side view; $\alpha_s = 0°$ and $-20°$.



(b) Front view; $\alpha_s = 0°$.

Figure 8.–Installation diagram of the model in the Aeroflightdynamics Directorate's 7– by 10–foot wind tunnel test section.



(a) With flap–lag structural coupling

(b) Without flap–lag structural coupling

Figure 9.–Hover test points.

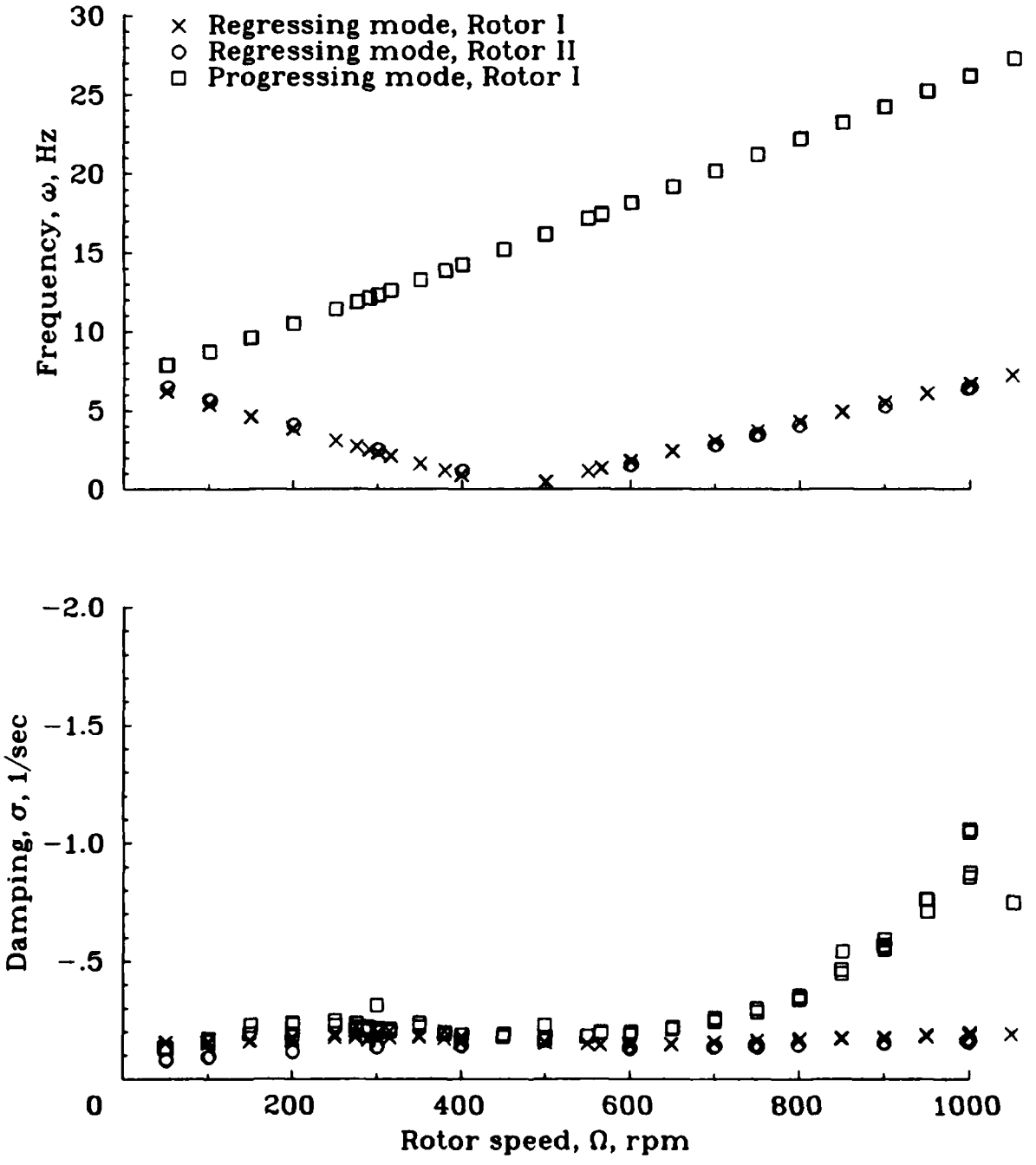


Figure 10.–Fixed system lead-lag frequencies and damping values versus rotor speed in hover; $\theta_0 = 0°$.

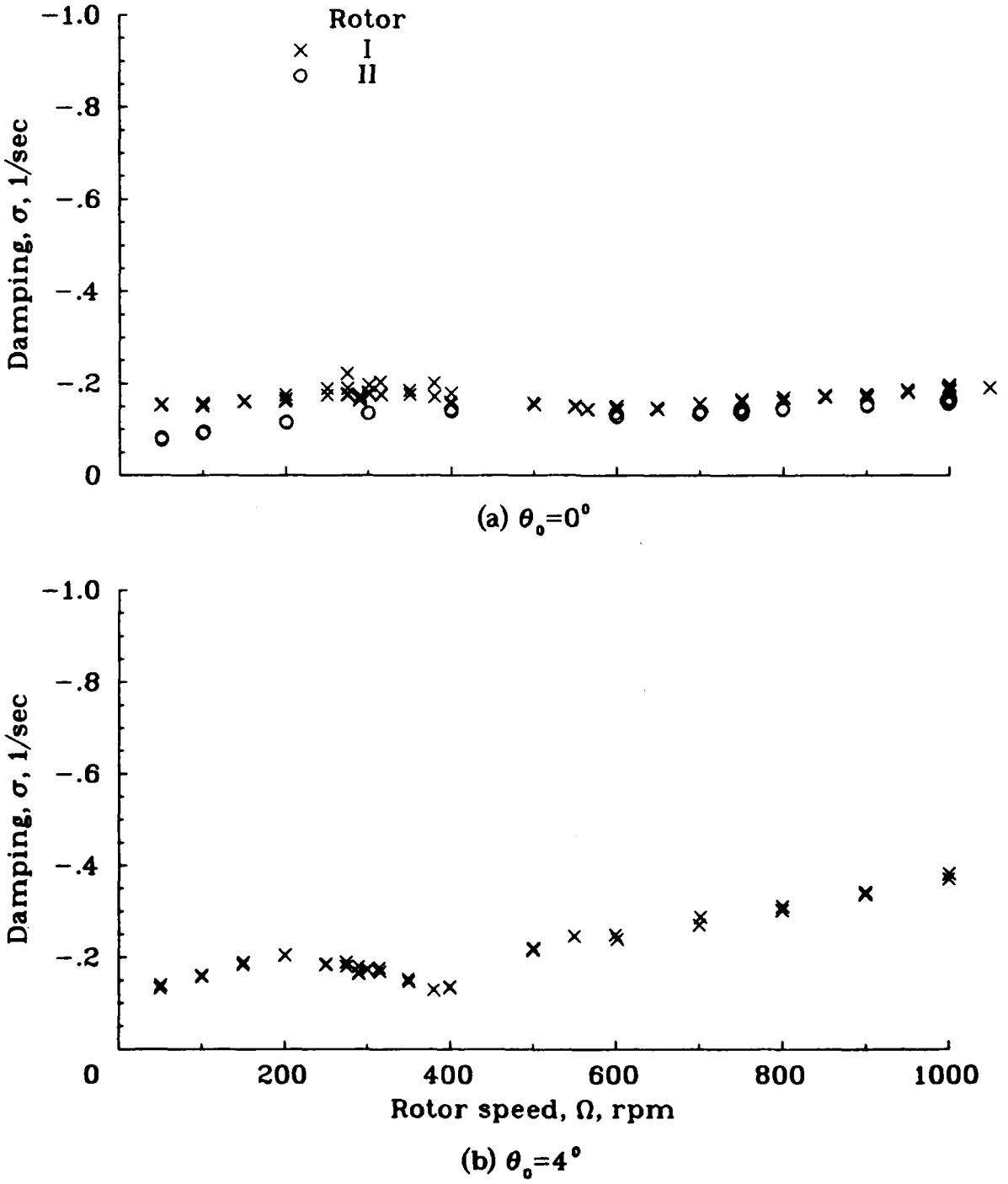
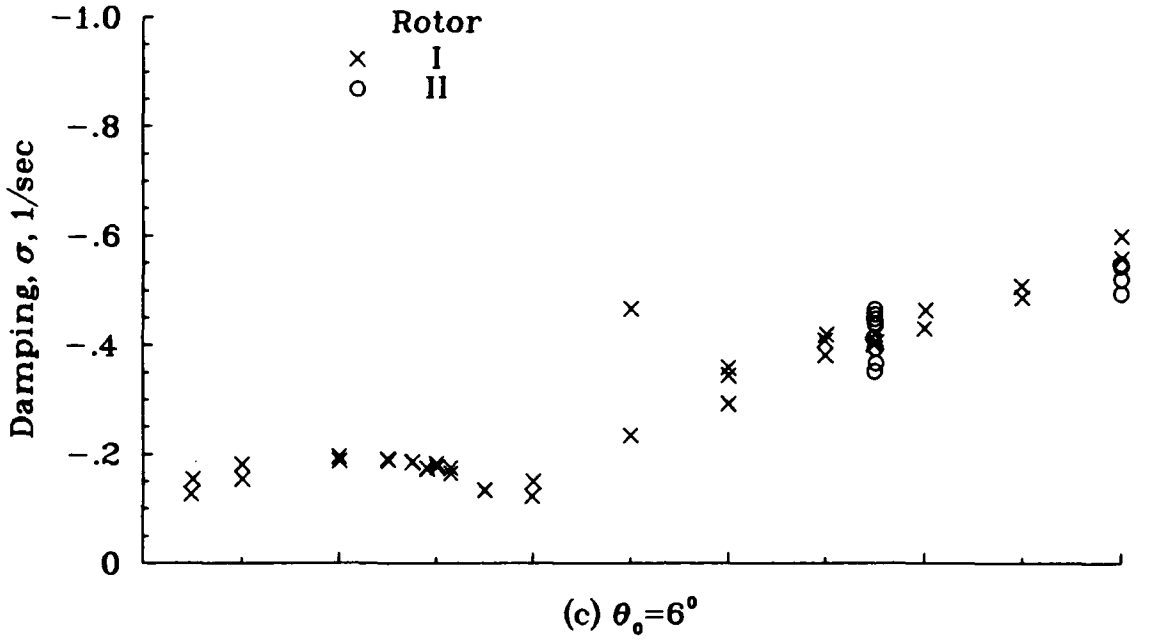
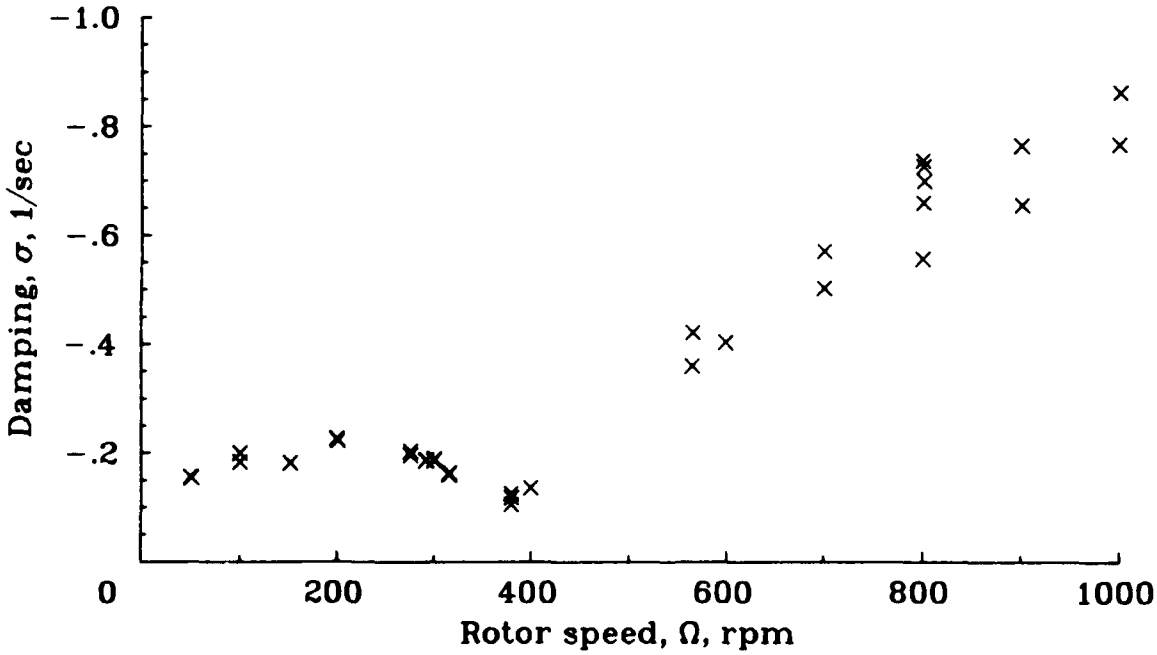


Figure 11.–Lead-lag regressing mode damping versus rotor speed in hover; configuration without flap-lag structural coupling.



(c) θ_0=6°



(d) θ_0=8°

Figure 11.–Concluded.

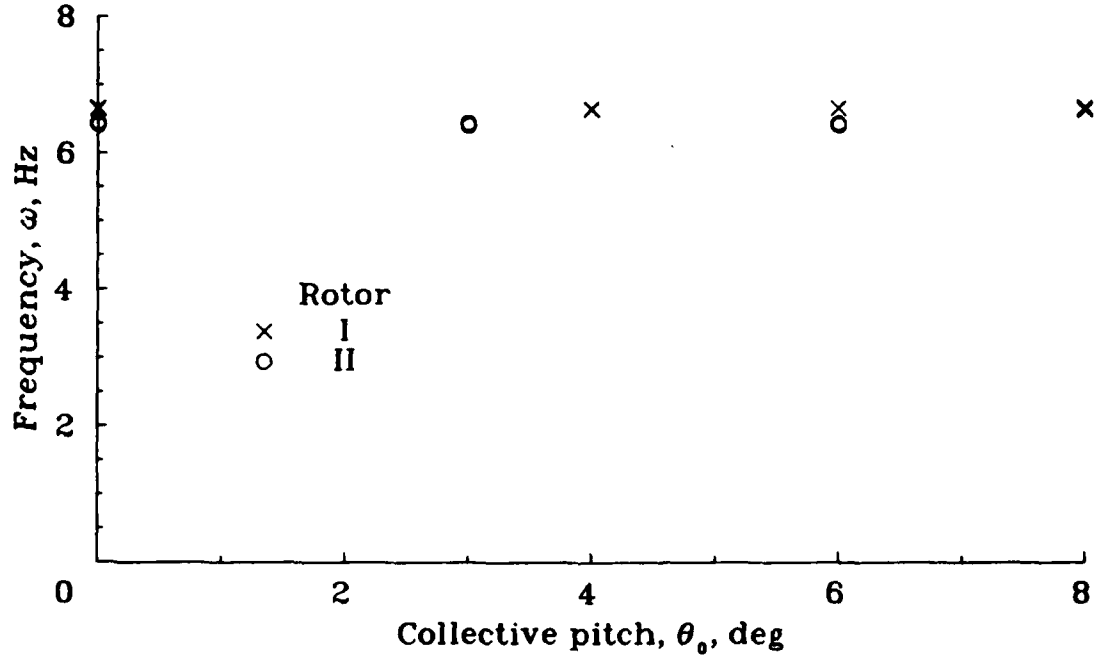


Figure 12.–Lead-lag regressing mode frequency versus collective pitch in hover; configuration without flap-lag structural coupling; 1000 rpm.

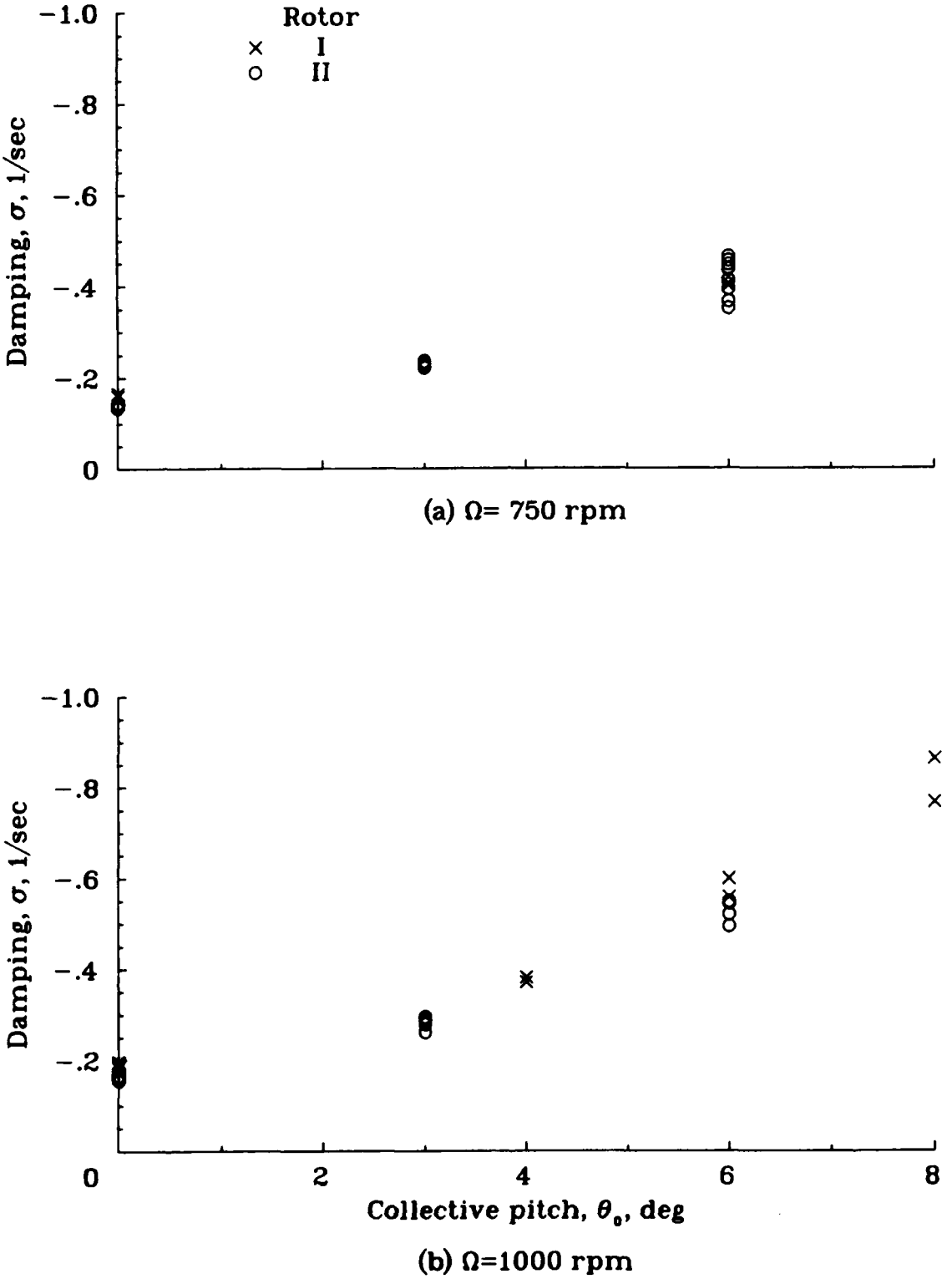
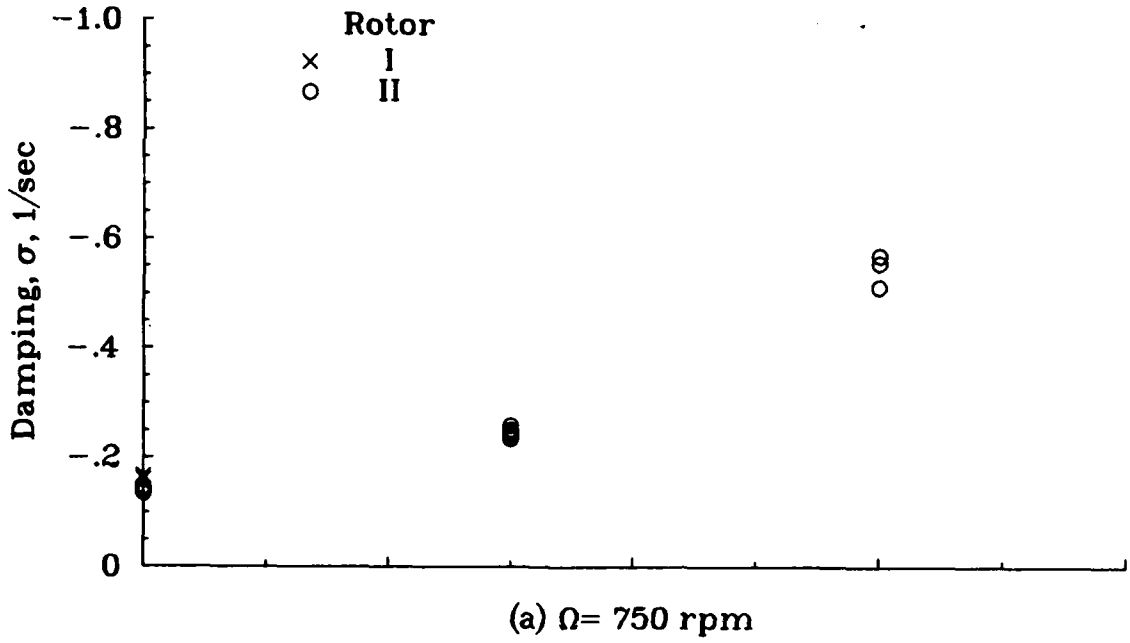
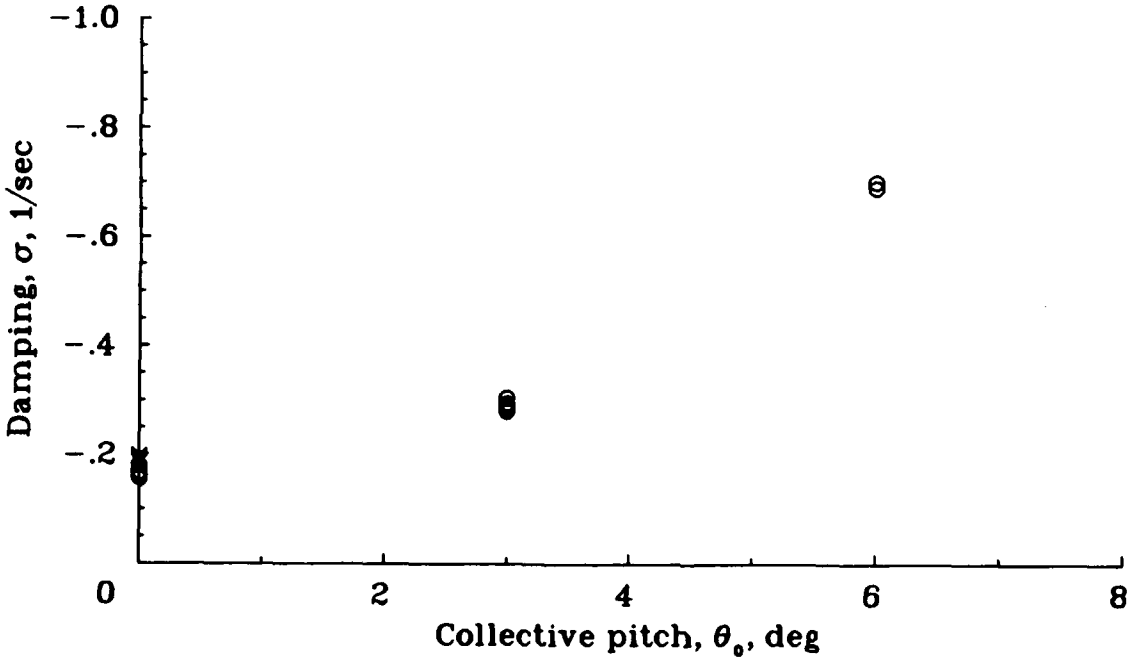


Figure 13.–Lead-lag regressing mode damping versus collective pitch in hover; configuration without flap-lag structural coupling.



(a) Ω= 750 rpm



(b) Ω=1000 rpm

Figure 14.–Lead-lag regressing mode damping versus collective pitch in hover; configuration with flap-lag structural coupling.

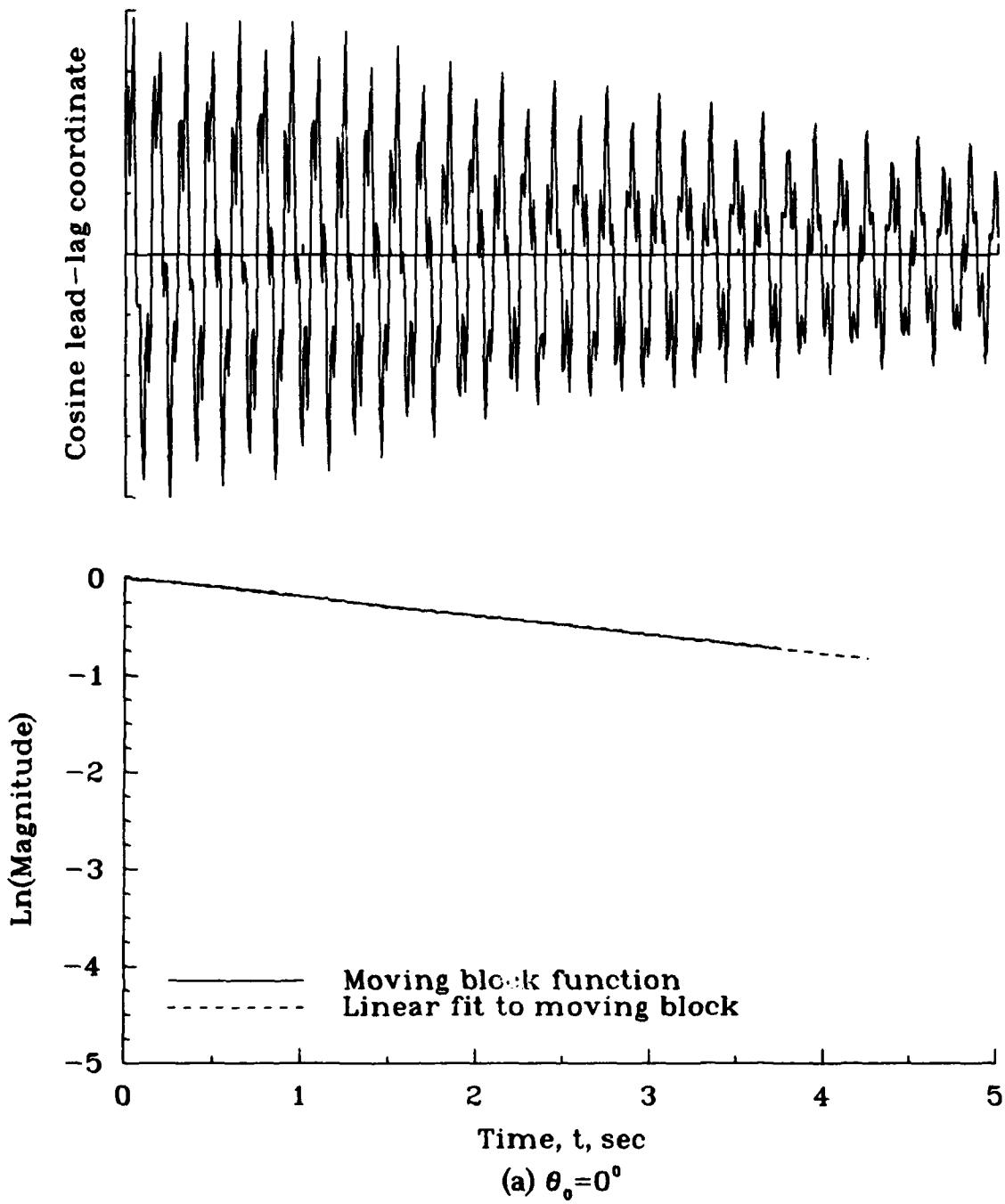
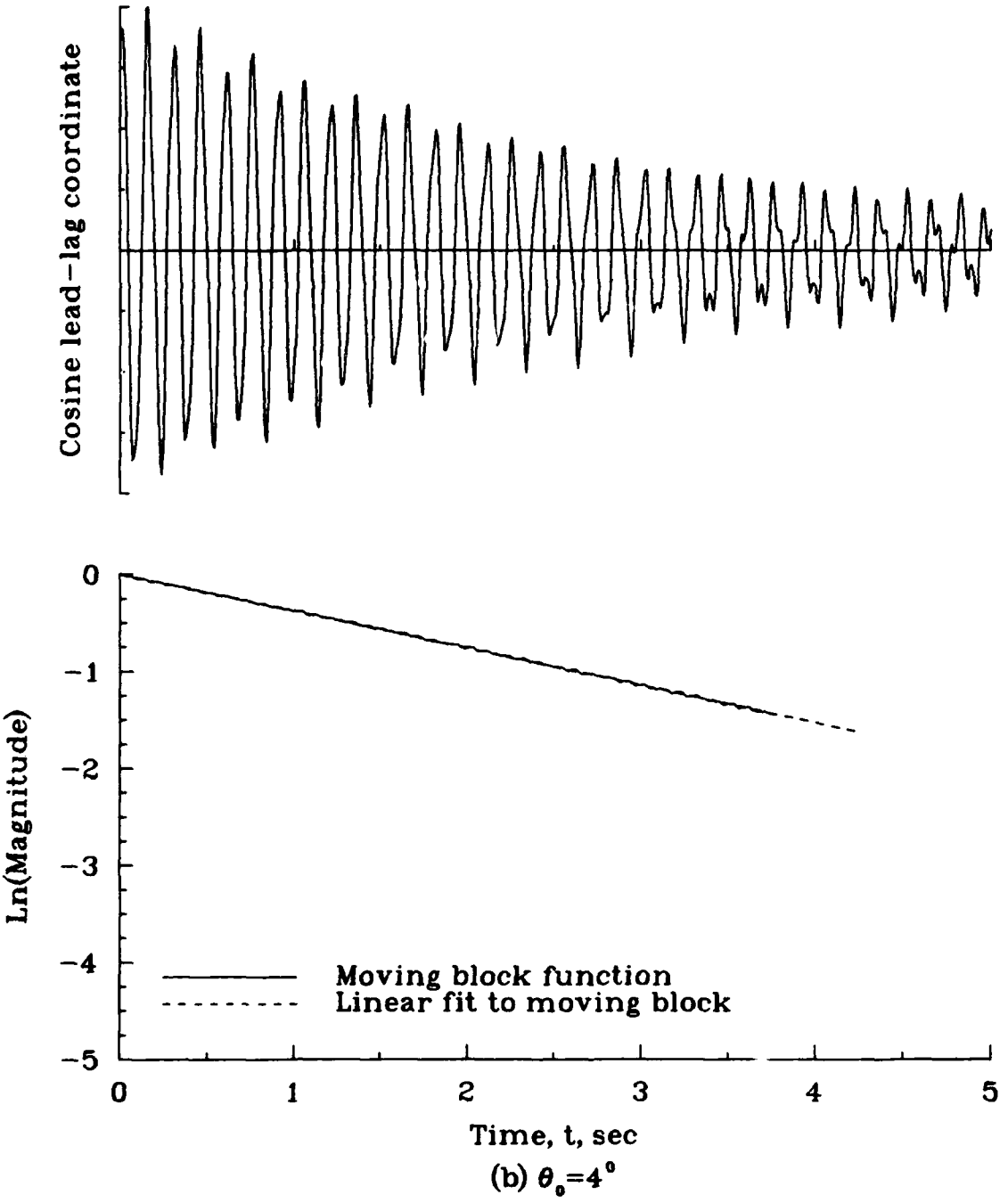
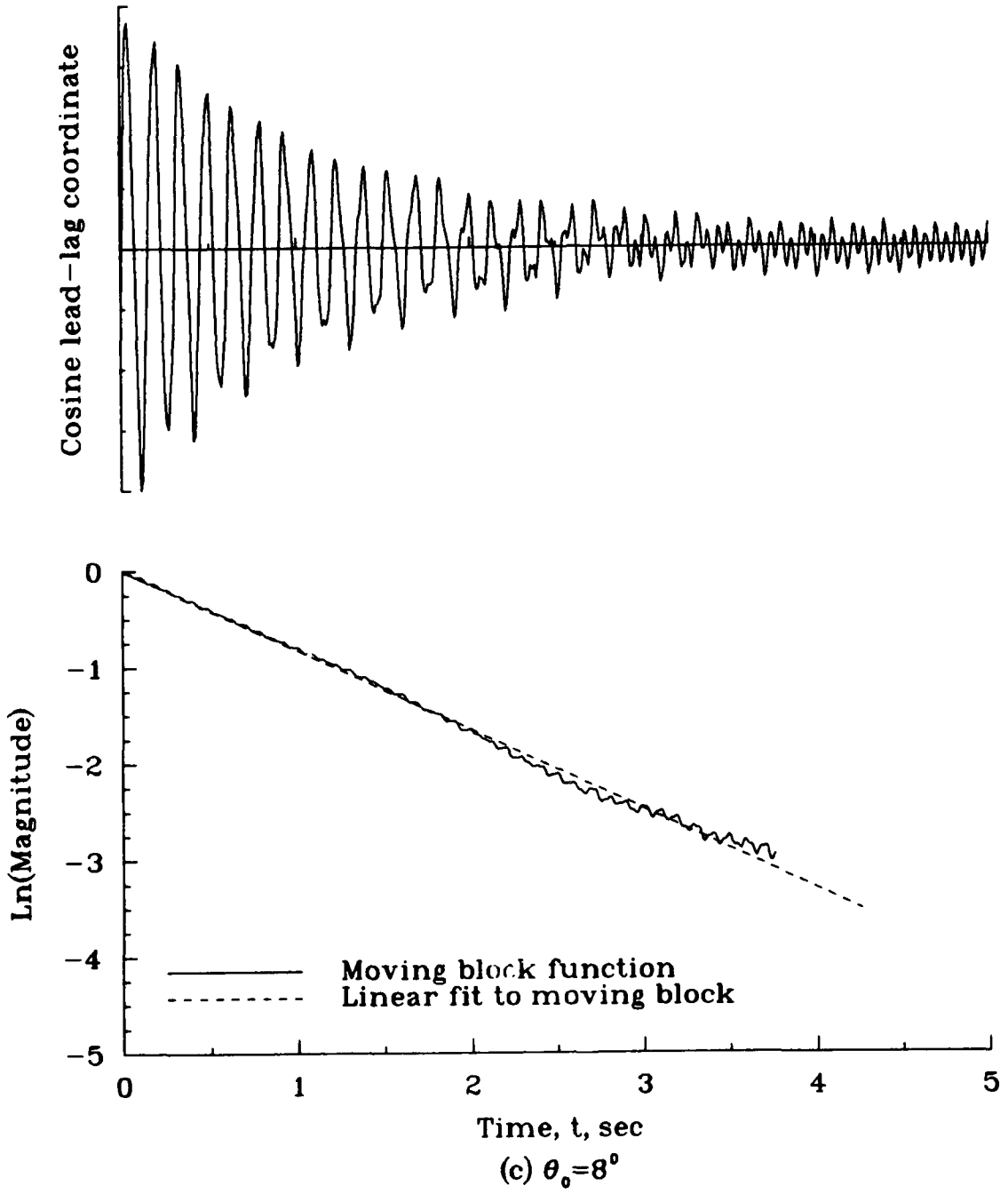


Figure 15.–Representative transient time histories in hover and their moving-block functions at the regressing lead-lag mode frequency; configuration without flap-lag structural coupling.



(b) $\theta_0=4^0$

Figure 15.–Continued.



(c) $\theta_0=8^\circ$

Figure 15.–Concluded.

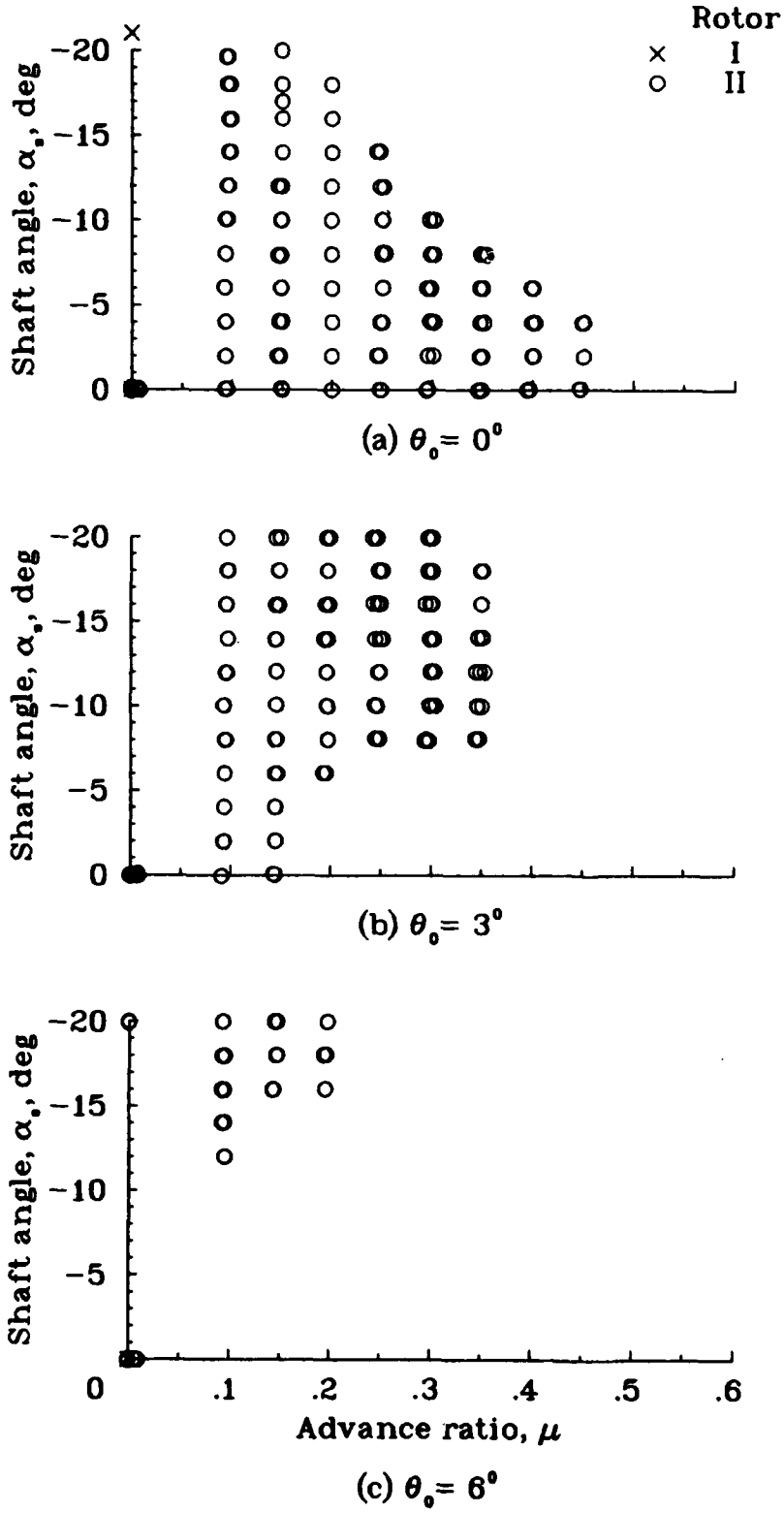


Figure 16.–Advance ratio, shaft angle, and collective pitch conditions tested at 750 rpm for the configuration without flap-lag structural coupling.

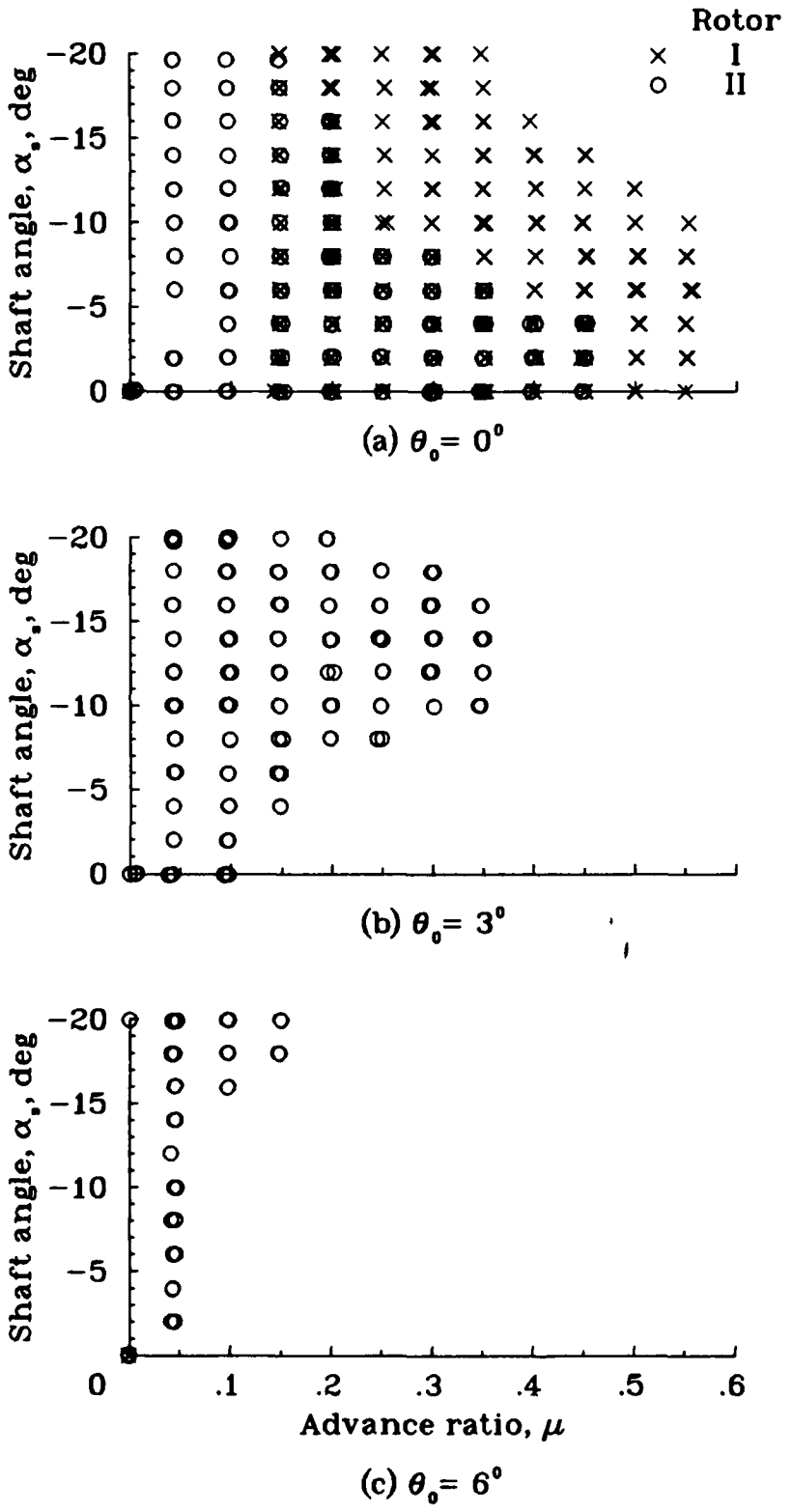


Figure 17.–Advance ratio, shaft angle, and collective pitch conditions tested at 1000 rpm for the configuration without flap-lag structural coupling.

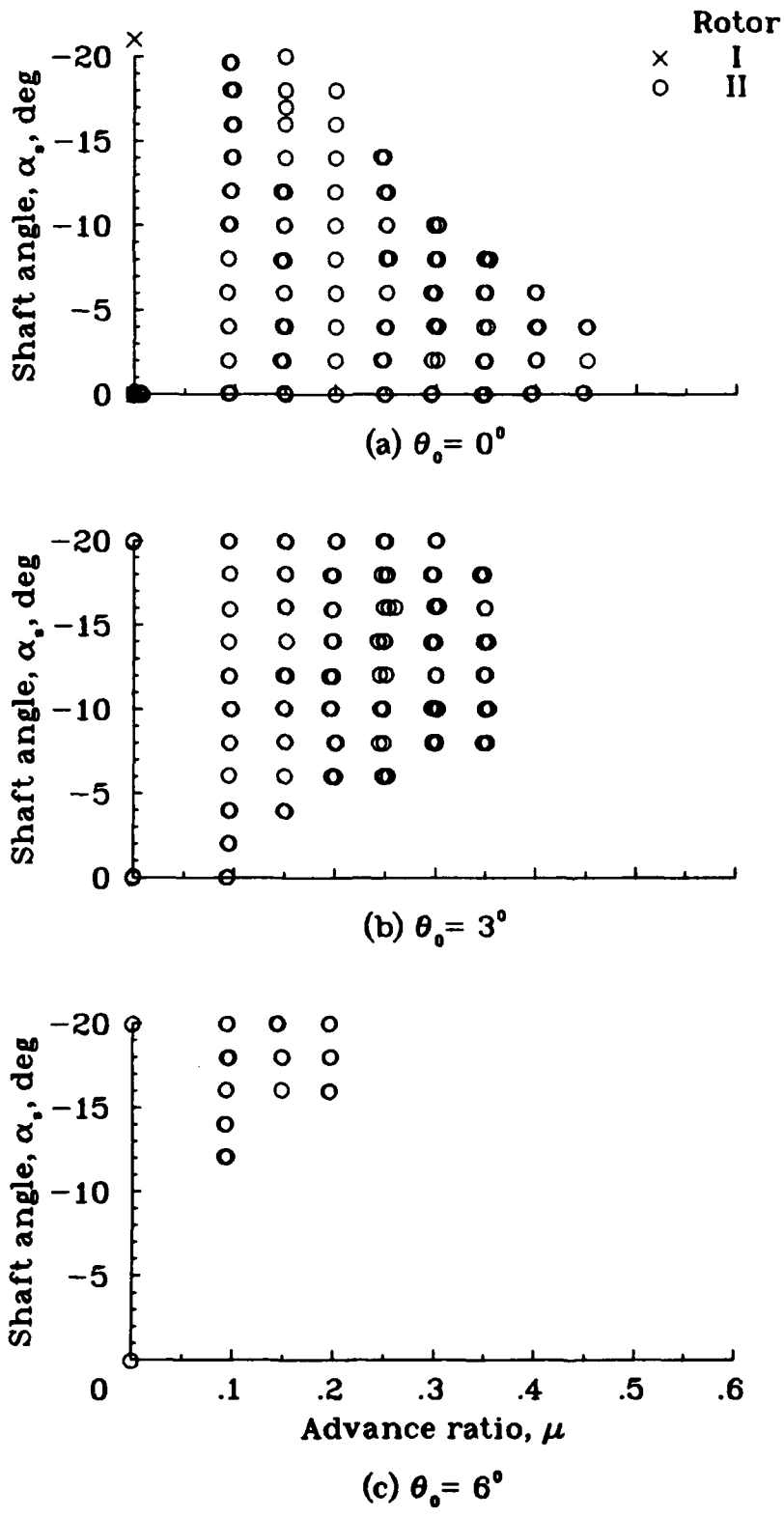


Figure 18.–Advance ratio, shaft angle, and collective pitch conditions tested at 750 rpm for the configuration with flap-lag structural coupling.

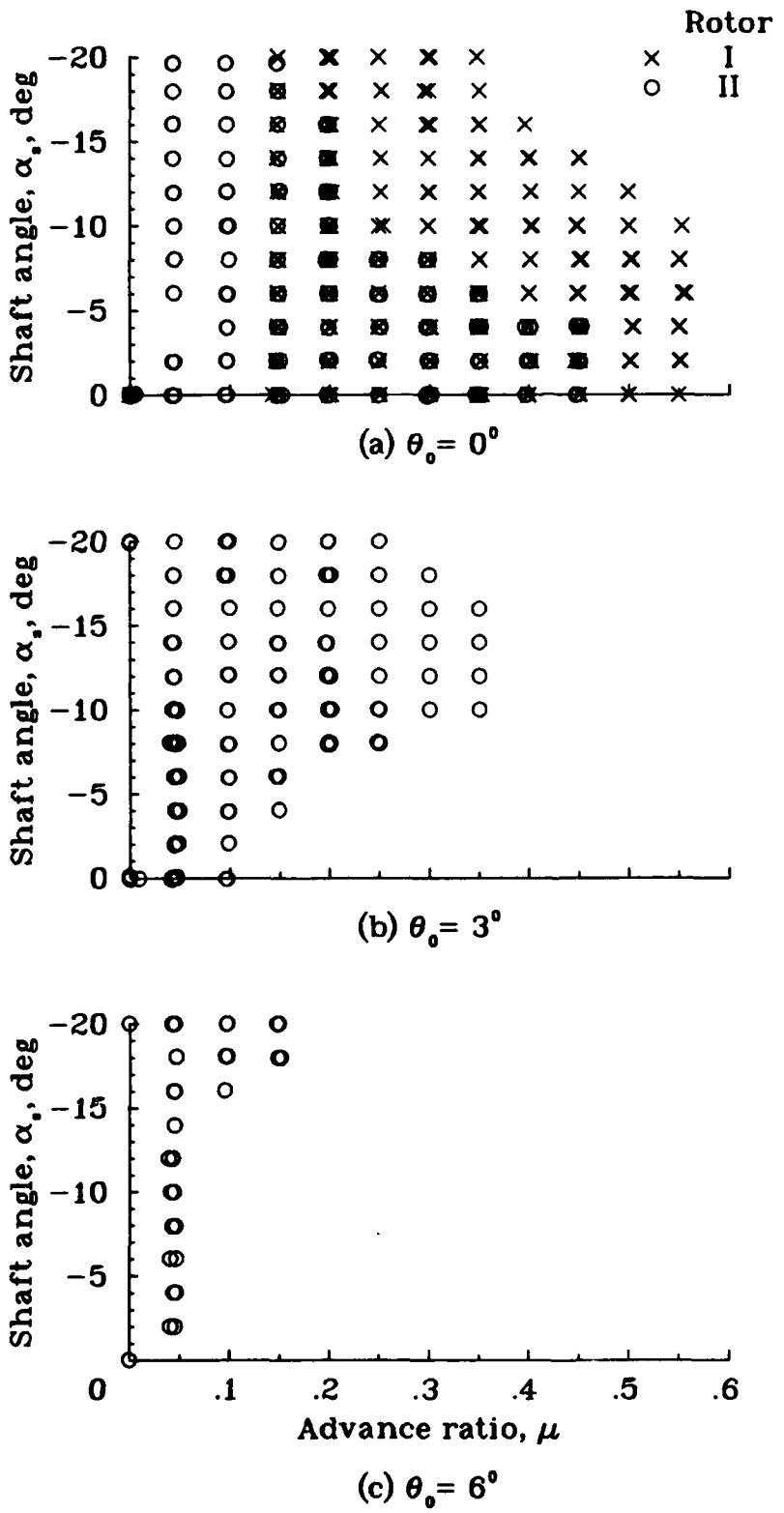


Figure 19.–Advance ratio, shaft angle, and collective pitch conditions tested at 1000 rpm for the configuration with flap-lag structural coupling.

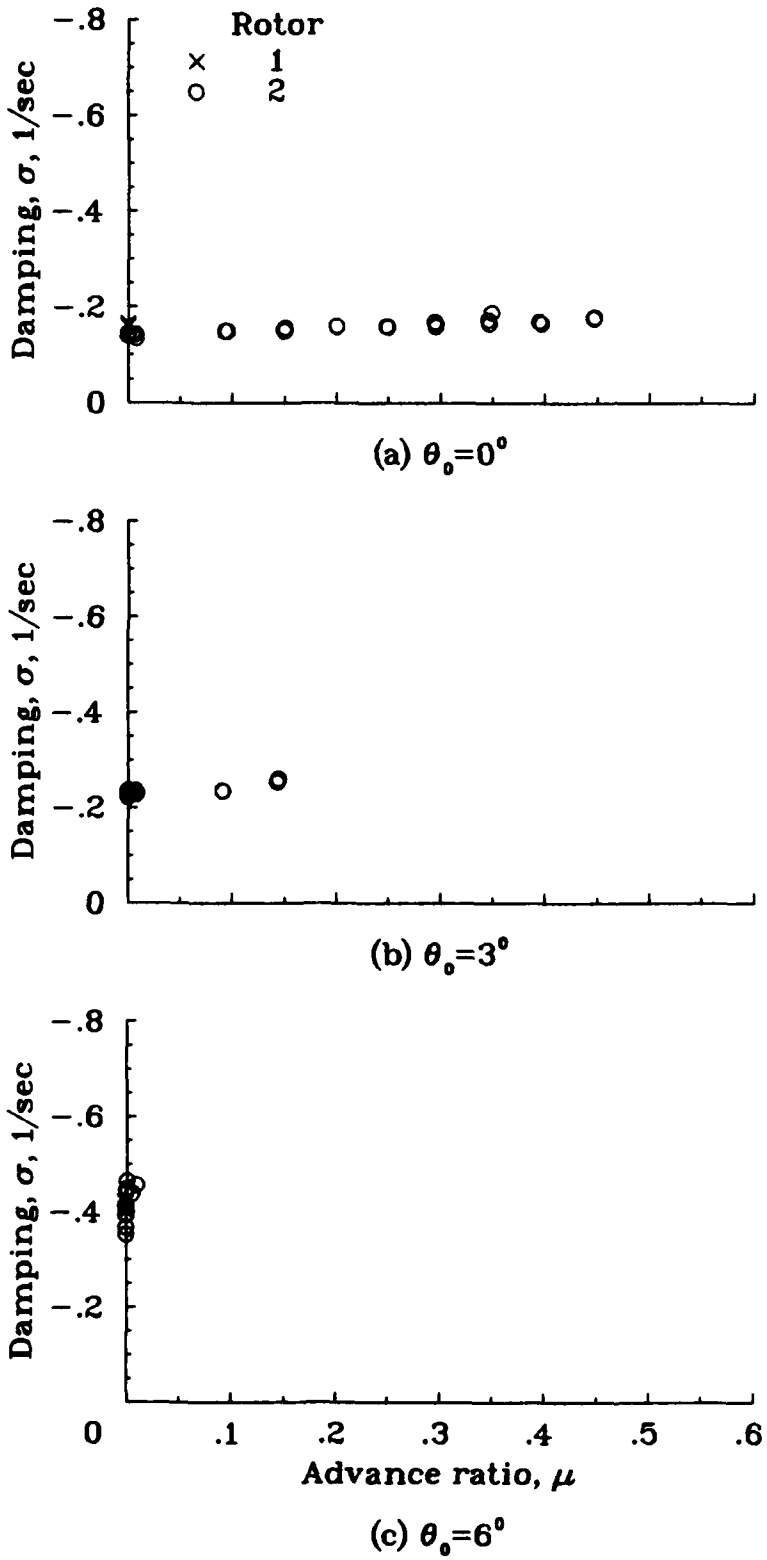


Figure 20.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 750 rpm, $\alpha_s = 0°$.

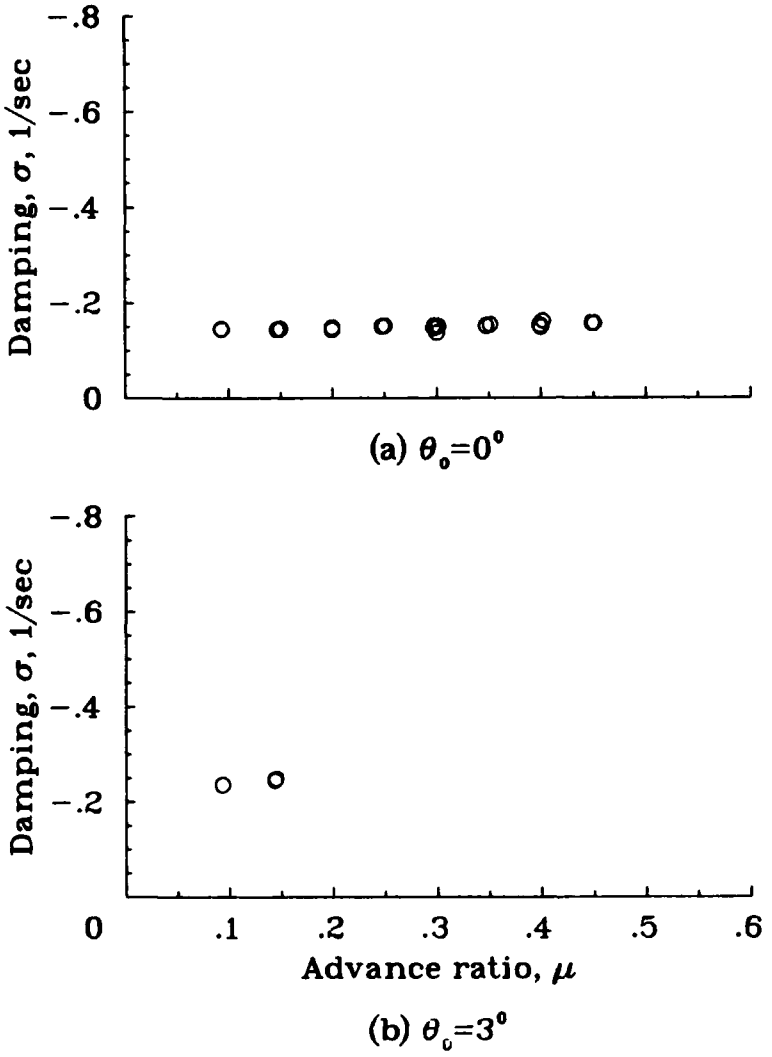


Figure 21.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 750 rpm, $\alpha_s = -4°$.

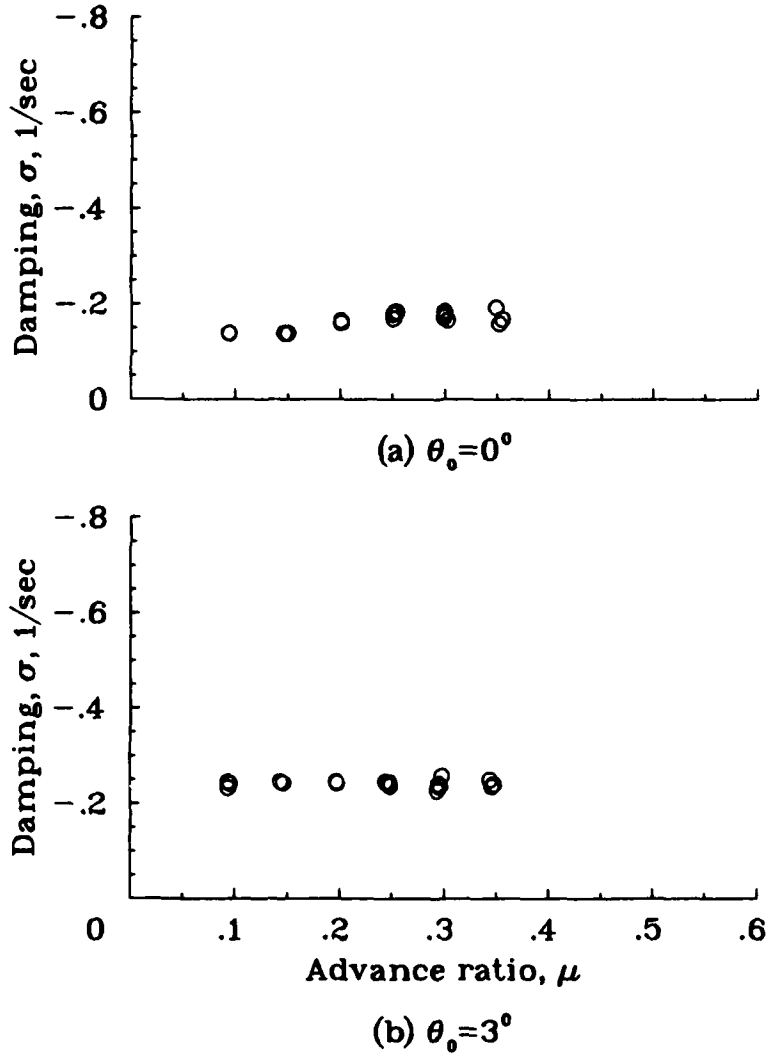


Figure 22.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 750 rpm, $\alpha_s = -8°$.

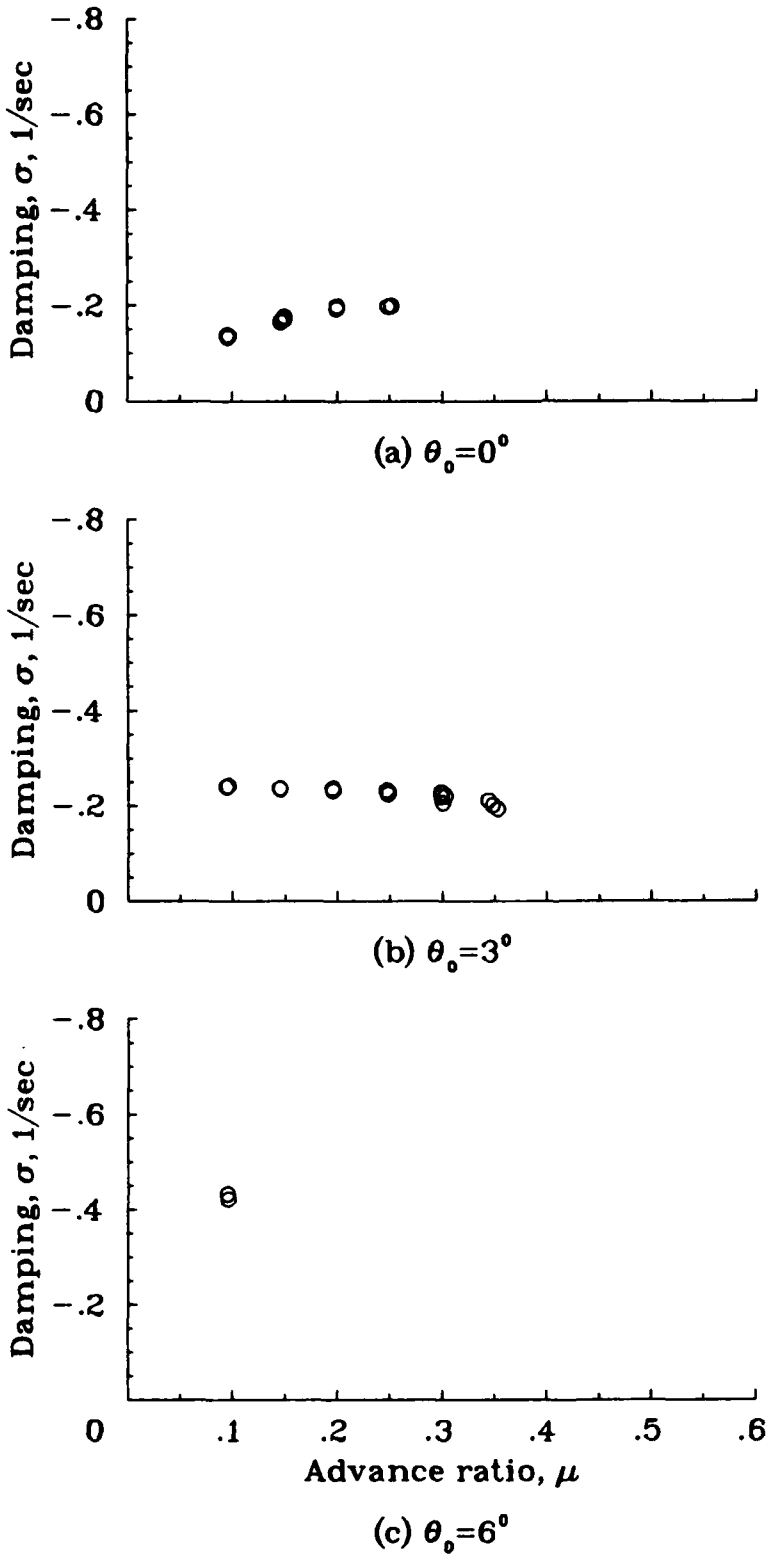


Figure 23.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 750 rpm, $\alpha_s = -12°$.

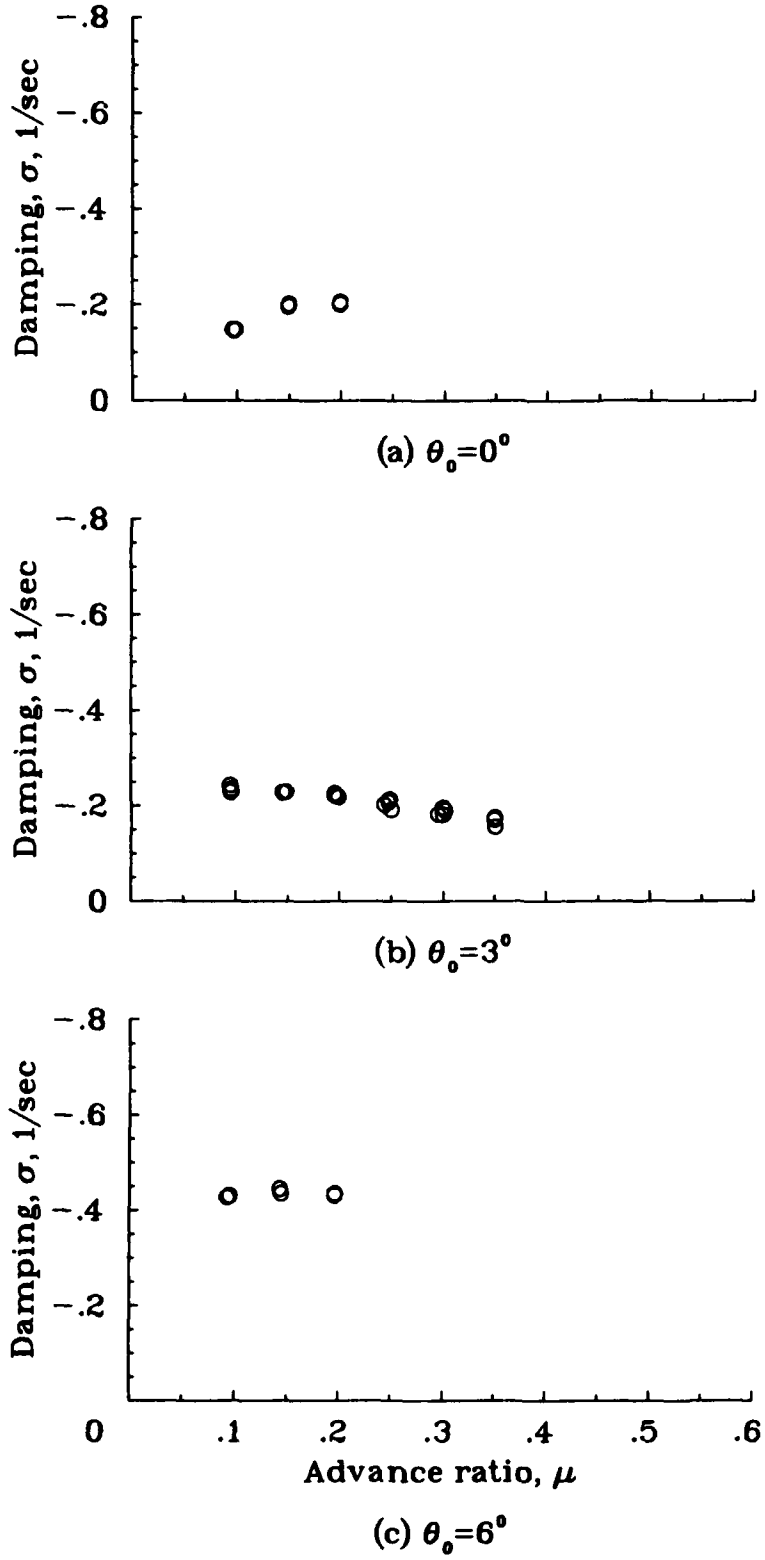


Figure 24.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 750 rpm, $\alpha_s = -16°$.

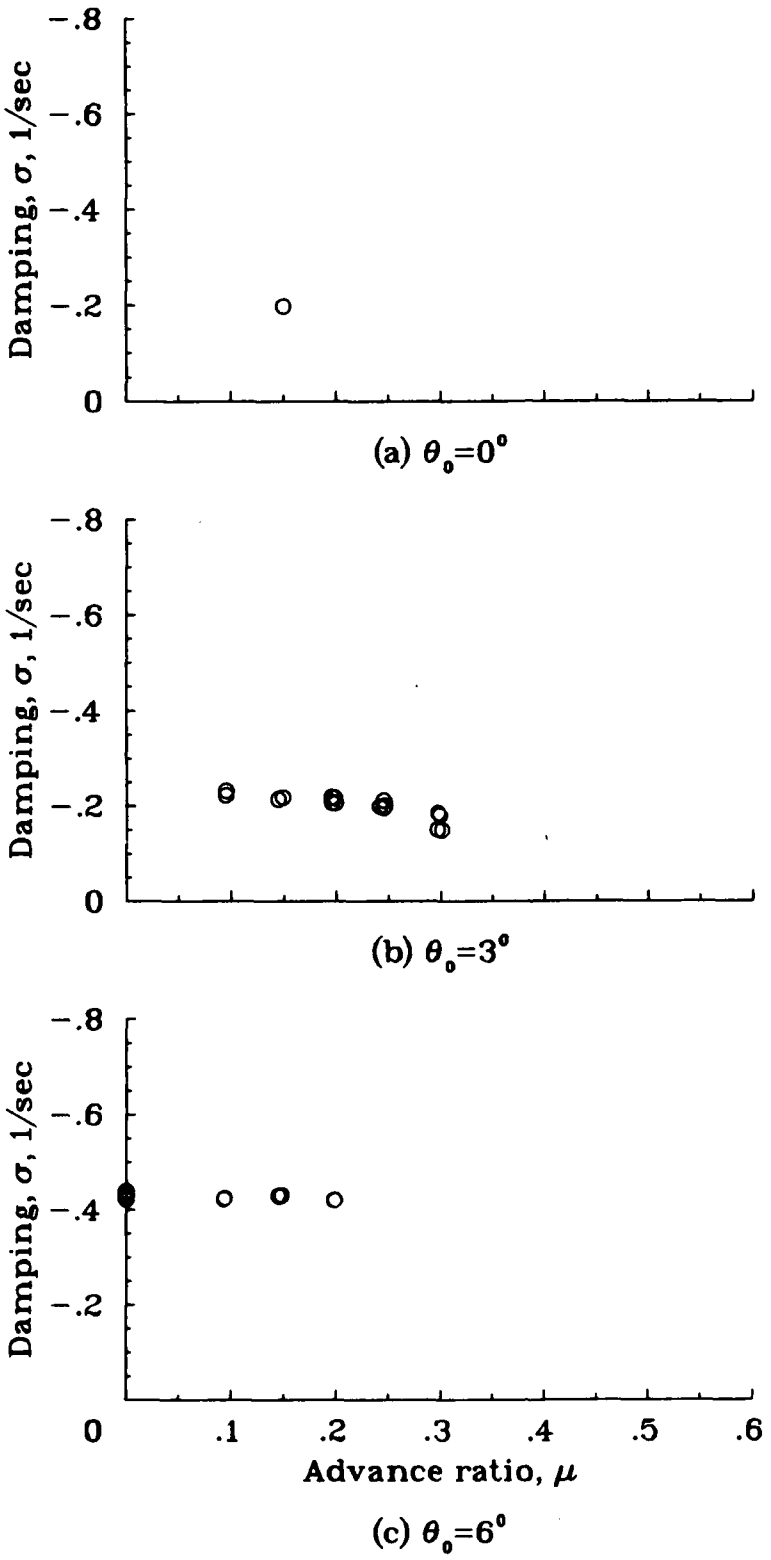


Figure 25.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 750 rpm, $\alpha_s = -20°$.

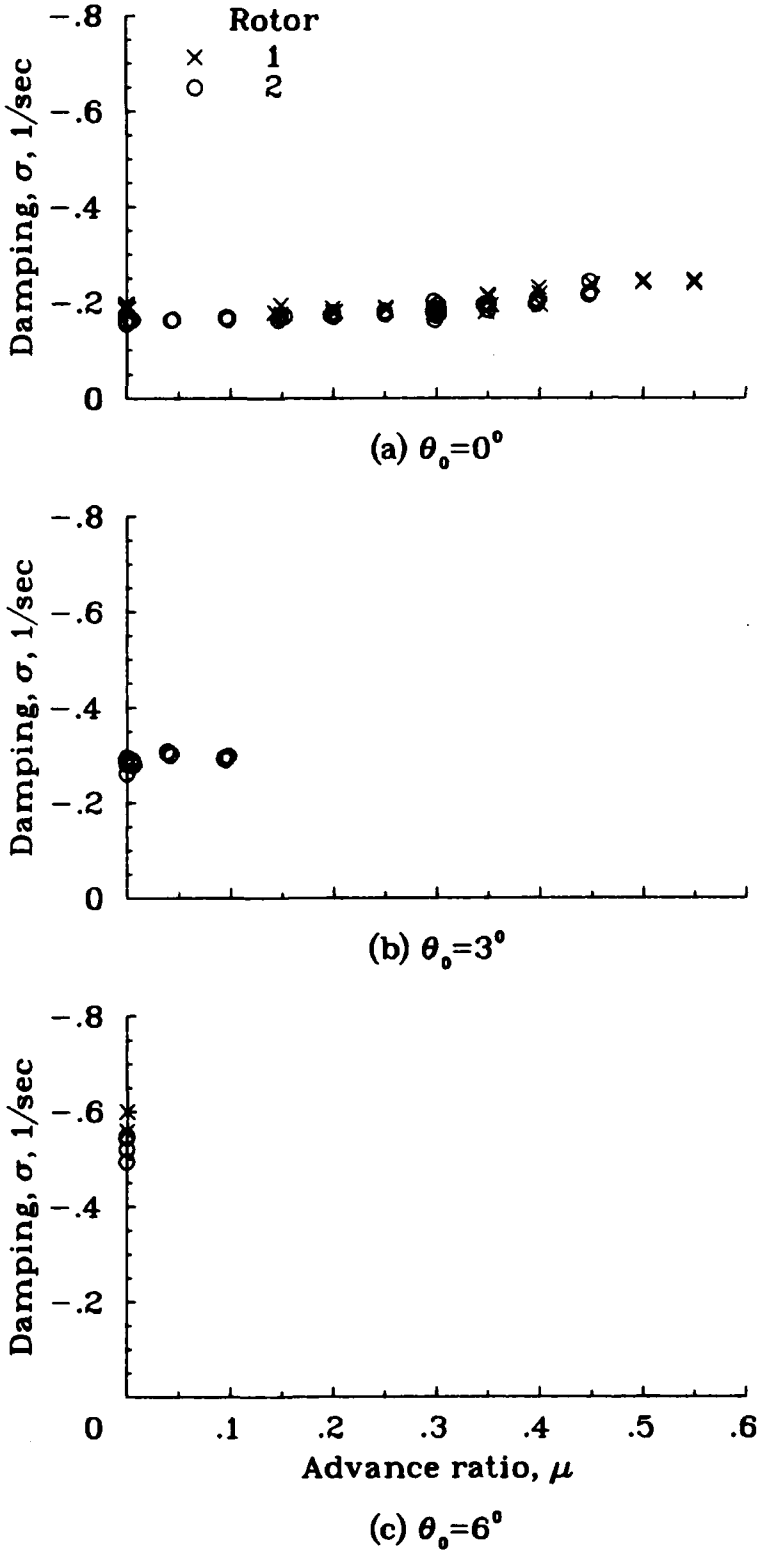


Figure 26.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 1000 rpm, $\alpha_s = 0°$.

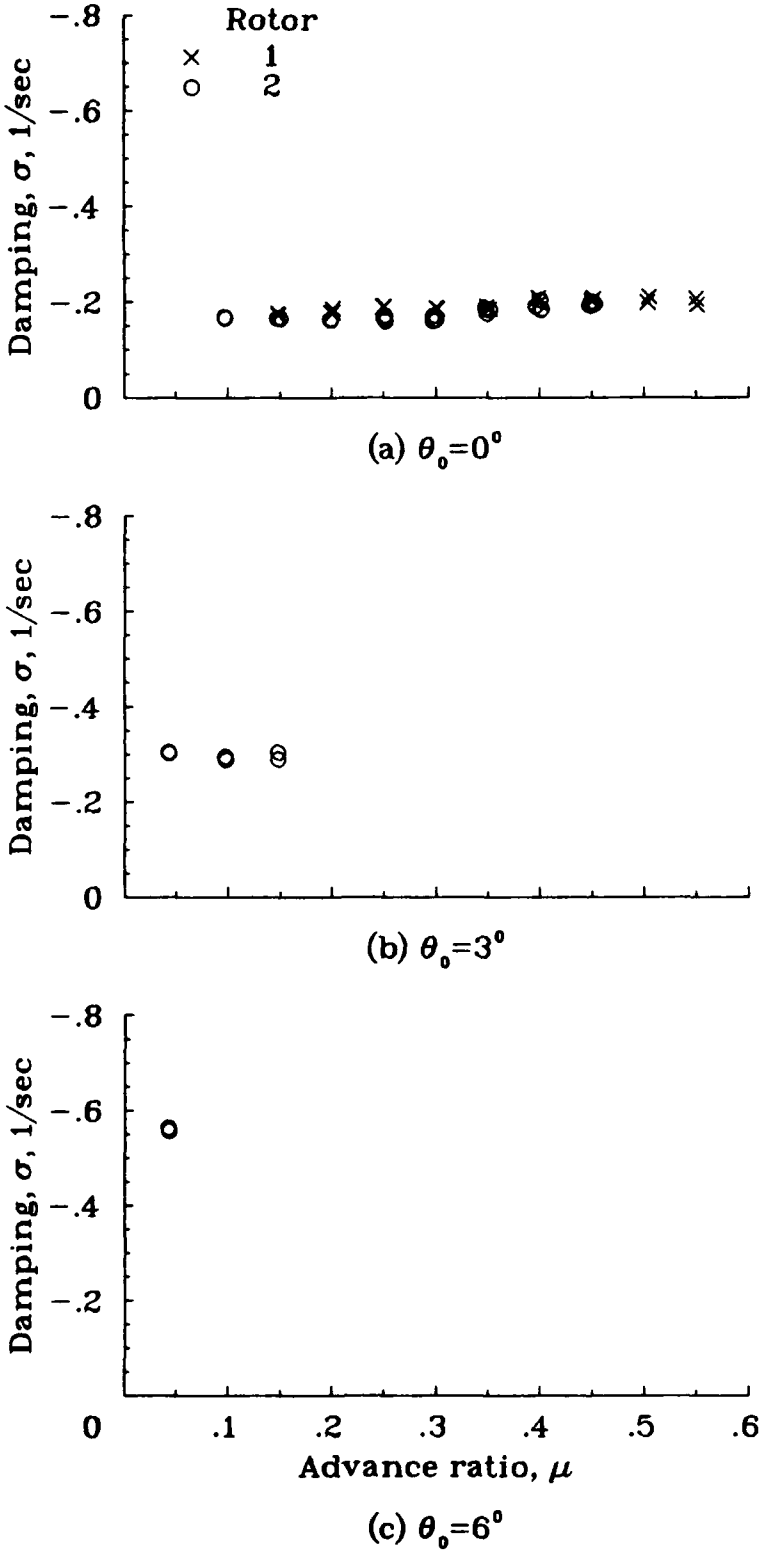


Figure 27.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 1000 rpm, $\alpha_s = -4°$.

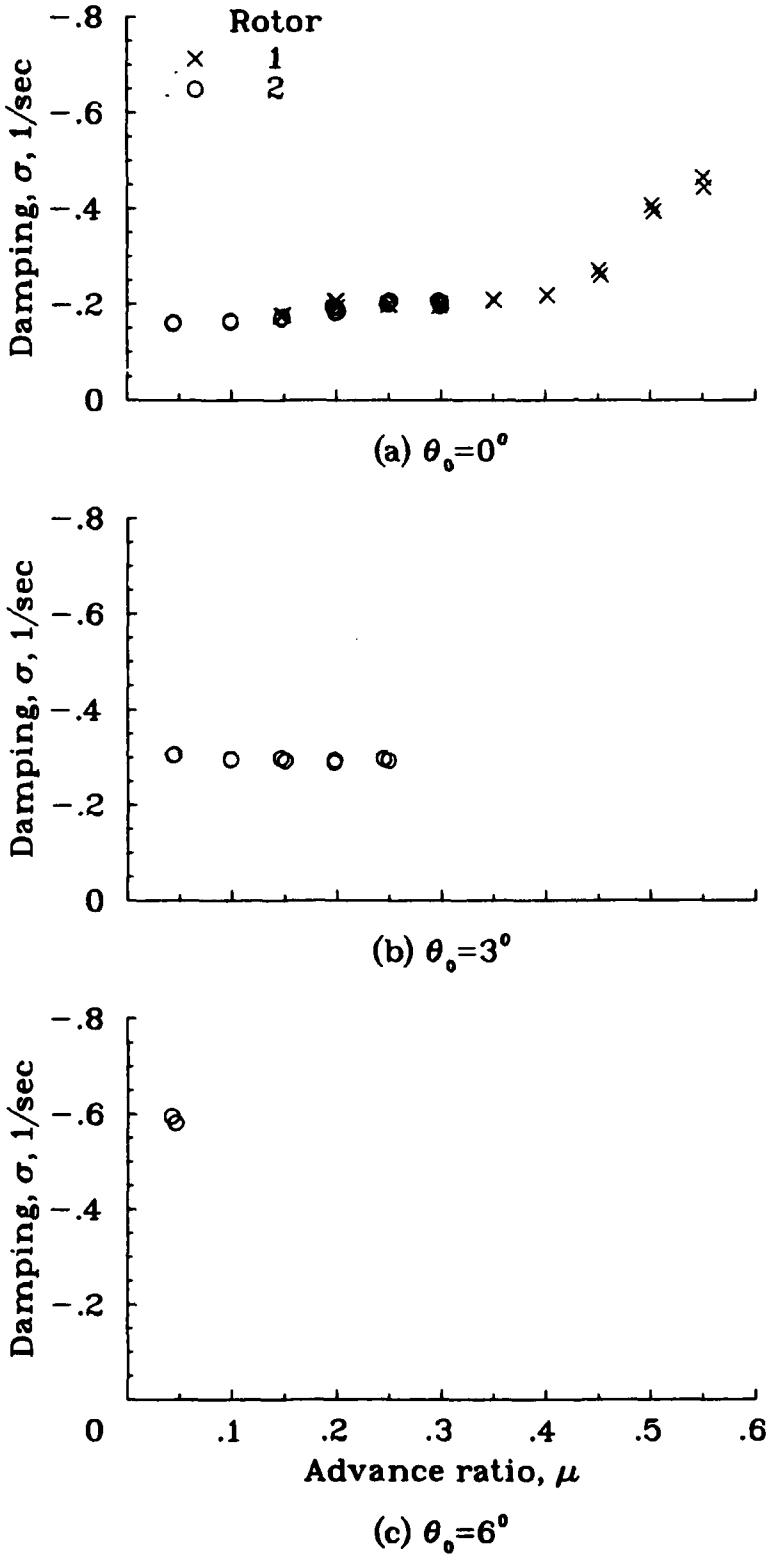


Figure 28.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 1000 rpm, $\alpha_s = -8°$.

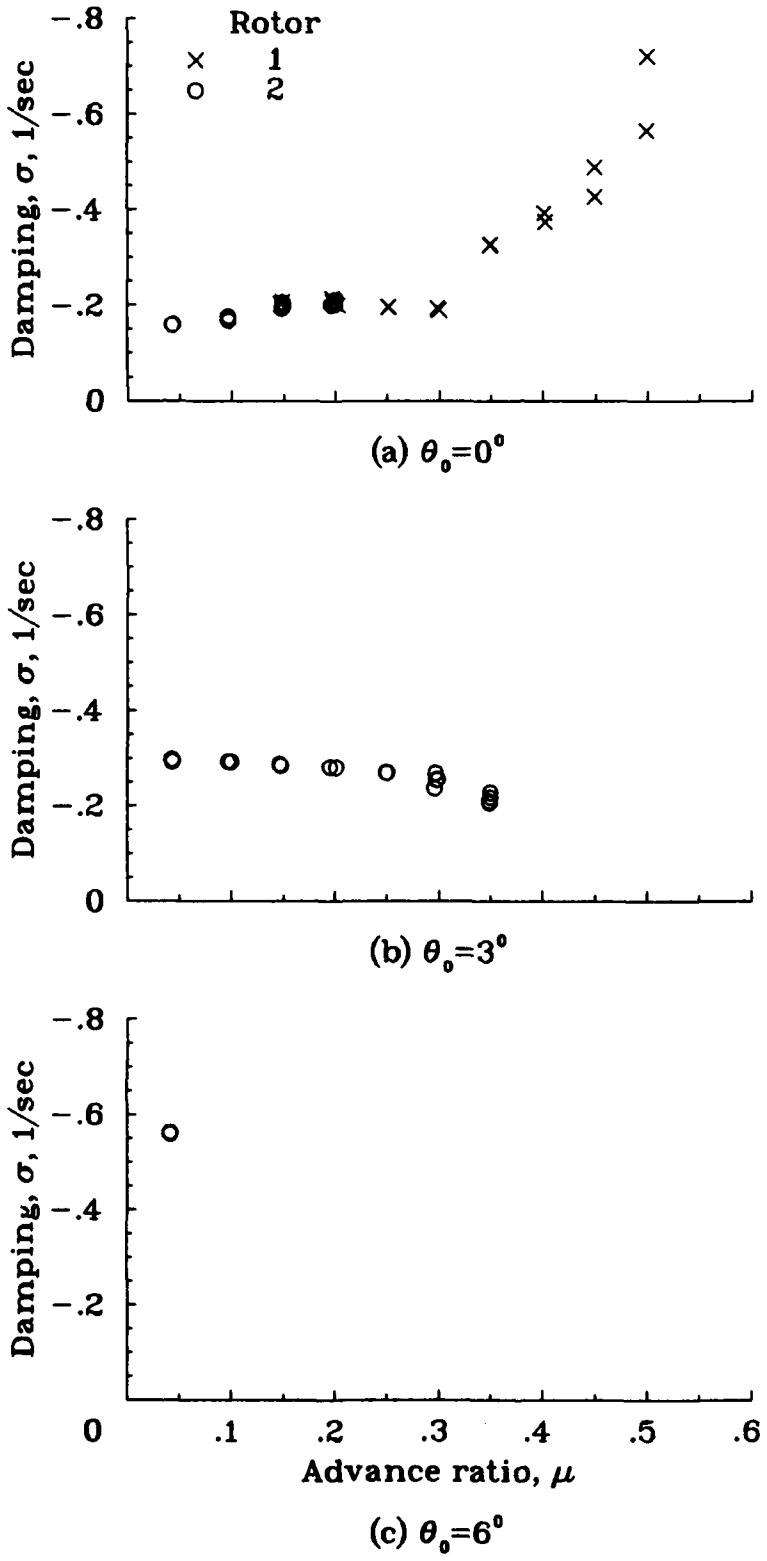


Figure 29.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 1000 rpm, $\alpha_s = -12°$.

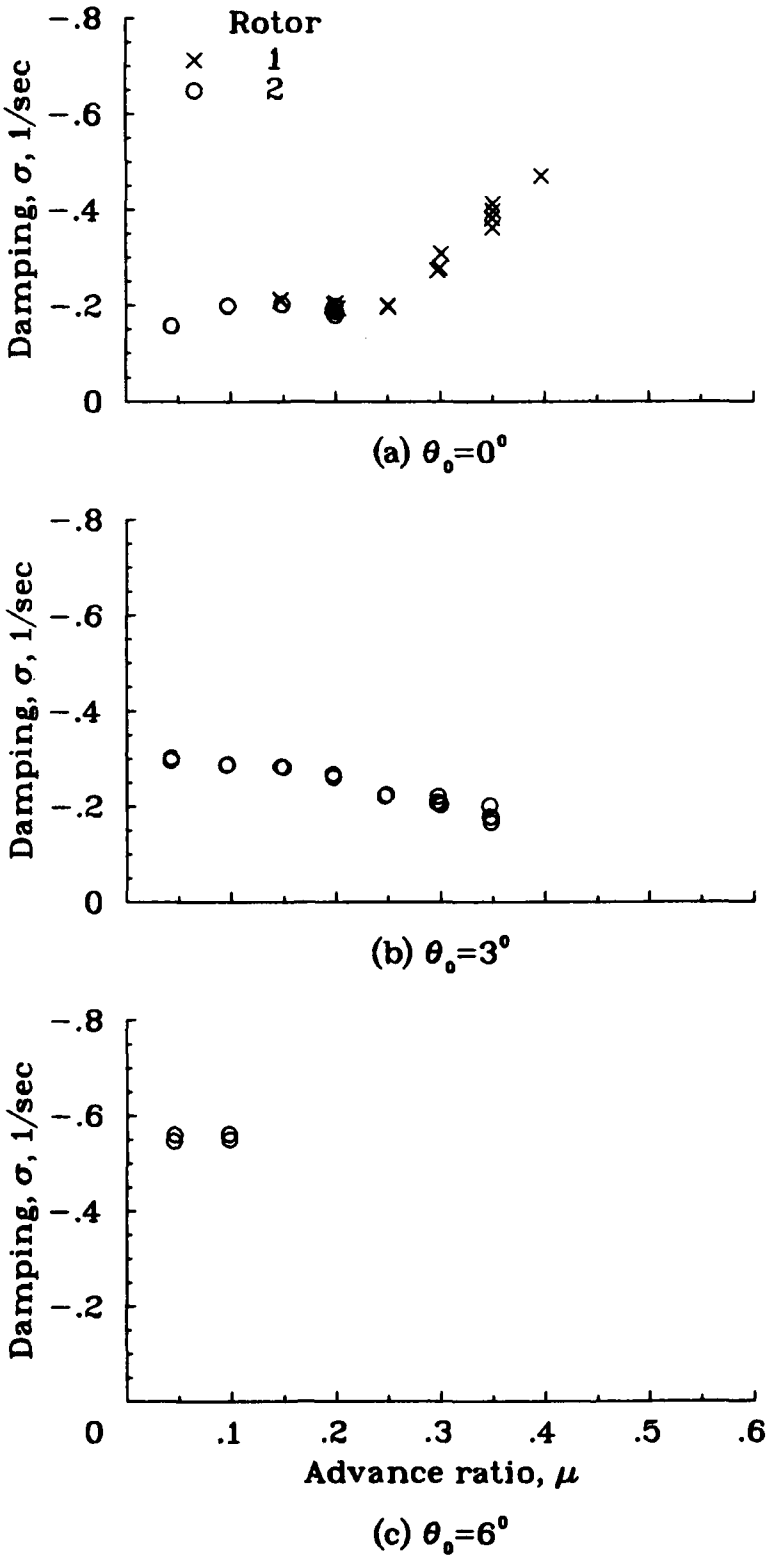


Figure 30.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 1000 rpm, $\alpha_s = -16°$.

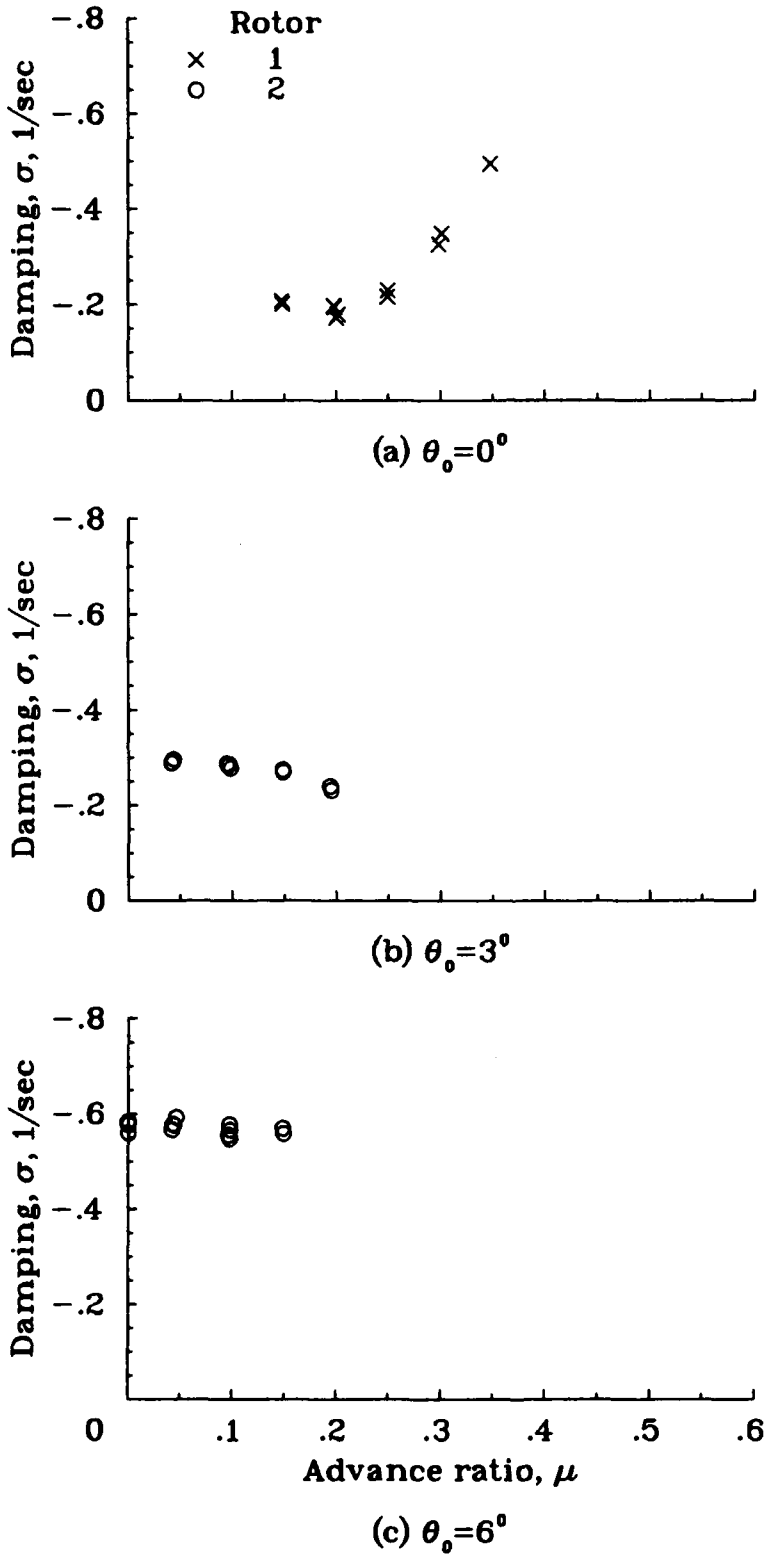


Figure 31.–Regressing lead-lag mode damping versus advance ratio; configuration without structural flap-lag coupling; 1000 rpm, $\alpha_s = -20°$.

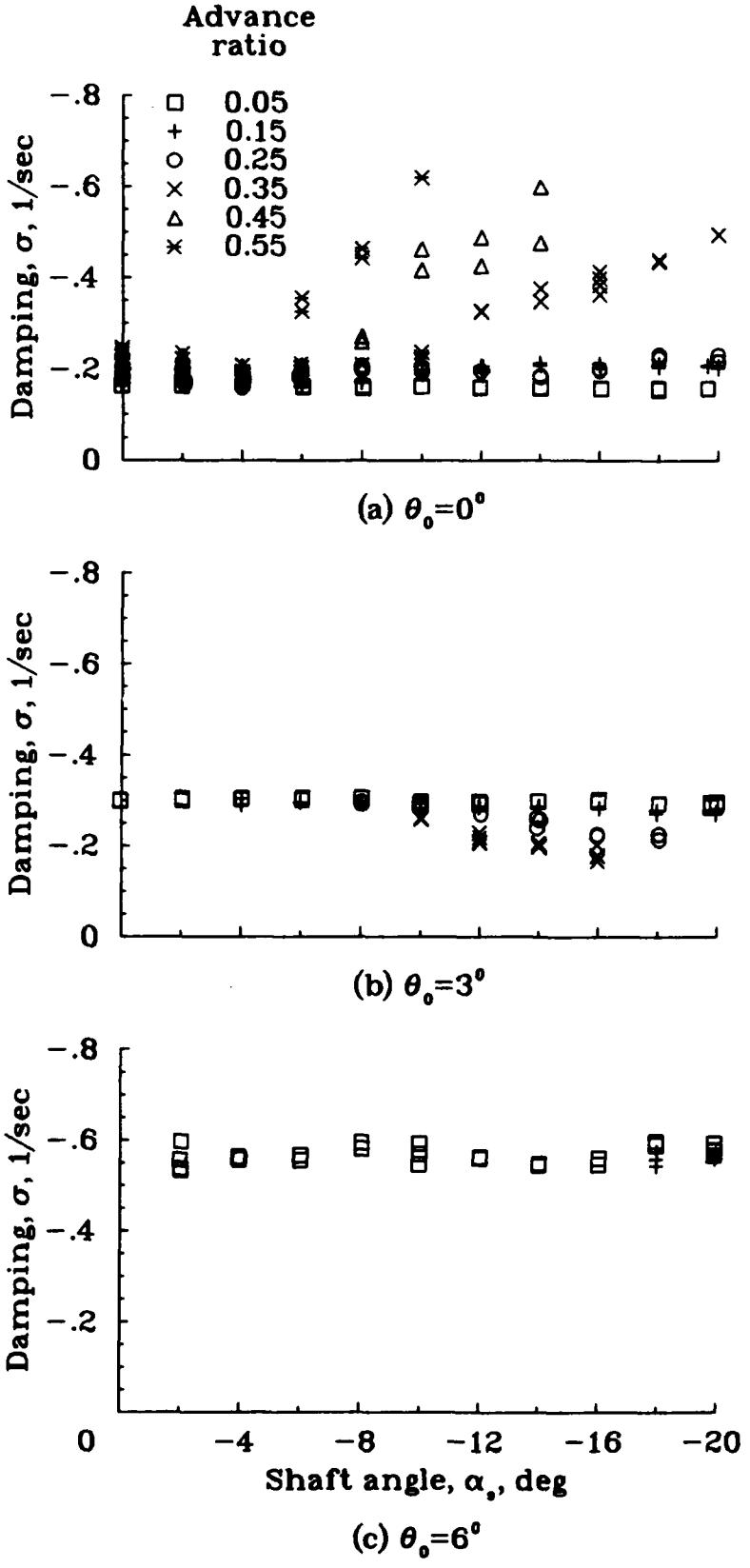


Figure 32.–Regressing lead-lag mode damping versus rotor shaft angle; configuration without structural flap-lag coupling; ; 1000 rpm; both Rotor I and Rotor II data are included without distinction.

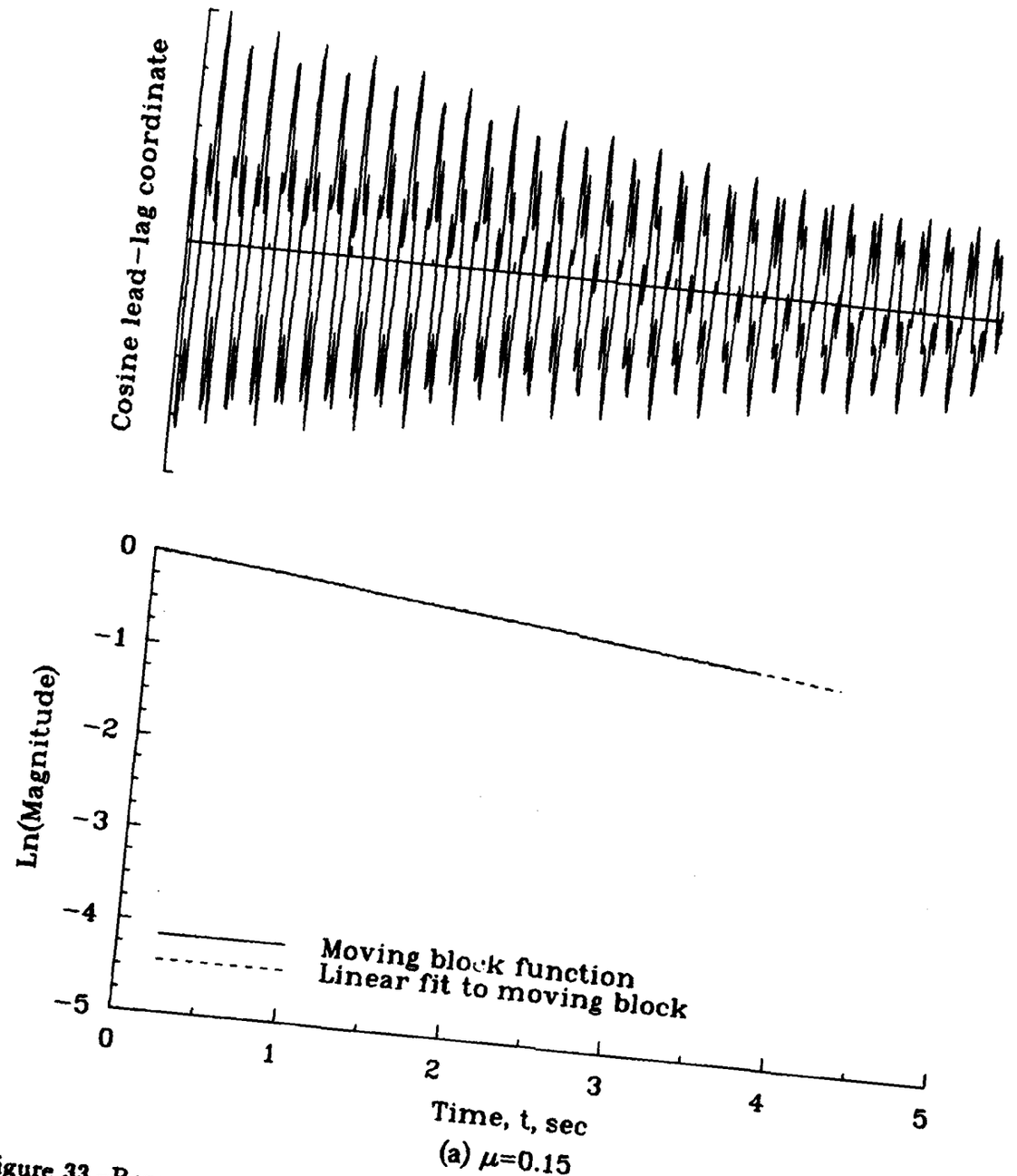
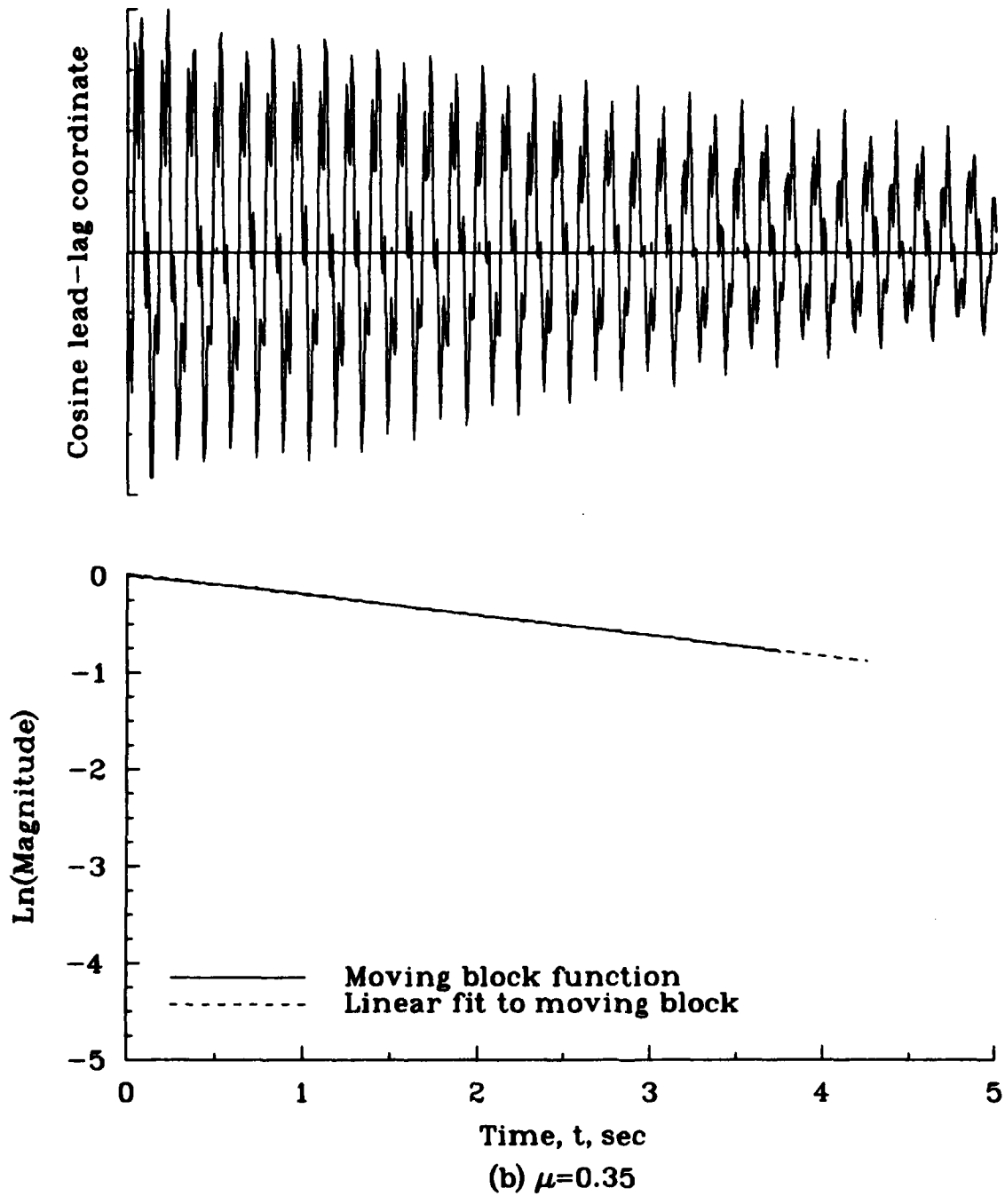


Figure 33.–Representative transient time histories in forward flight and their moving-block functions at the regressing lead-lag mode frequency; configuration without flap-lag structural coupling; $\theta_0 = 0°$, 1000 rpm, $\alpha_s = 0°$.



(b) μ=0.35

Figure 33.–Continued.

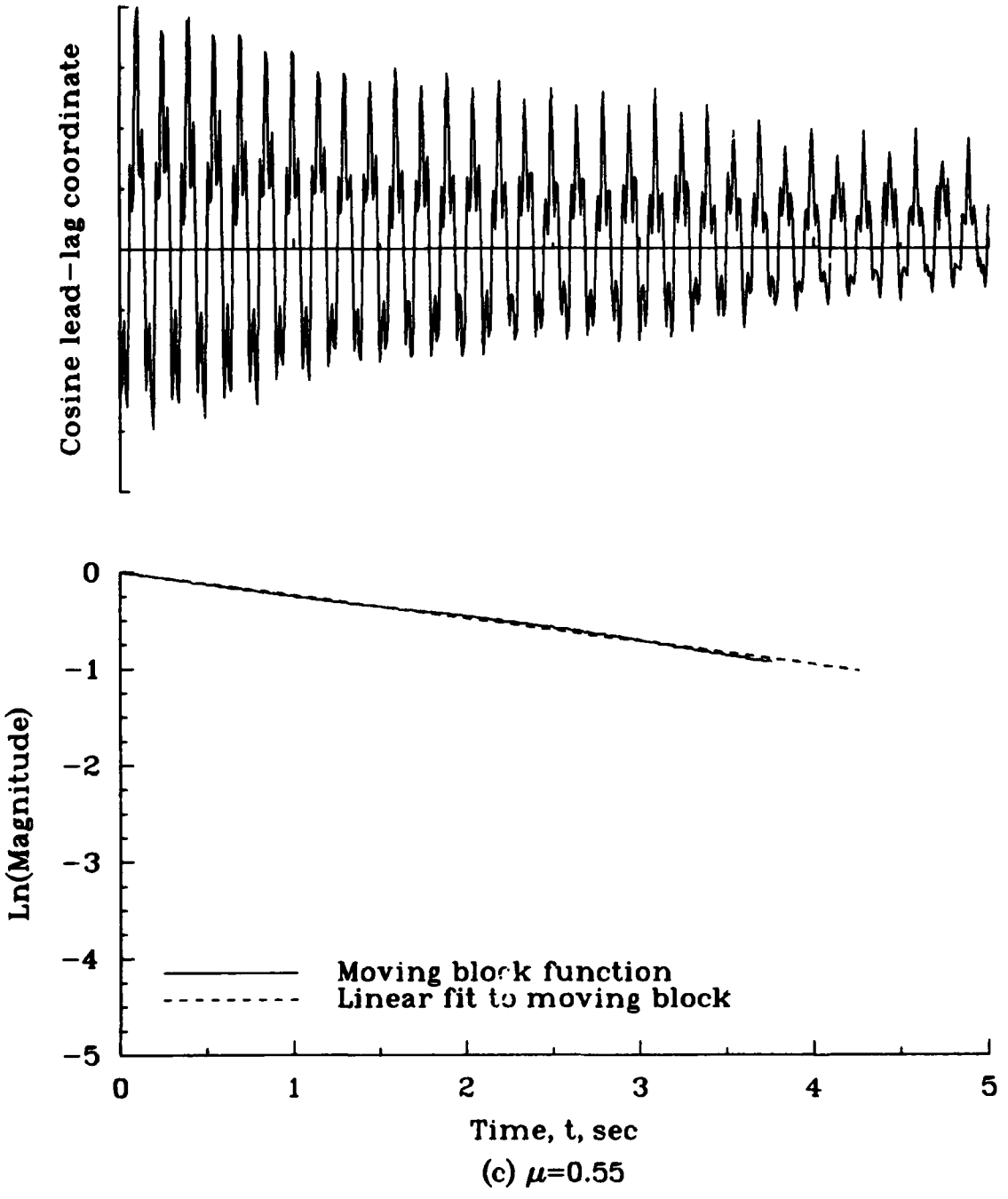


Figure 33.–Concluded.

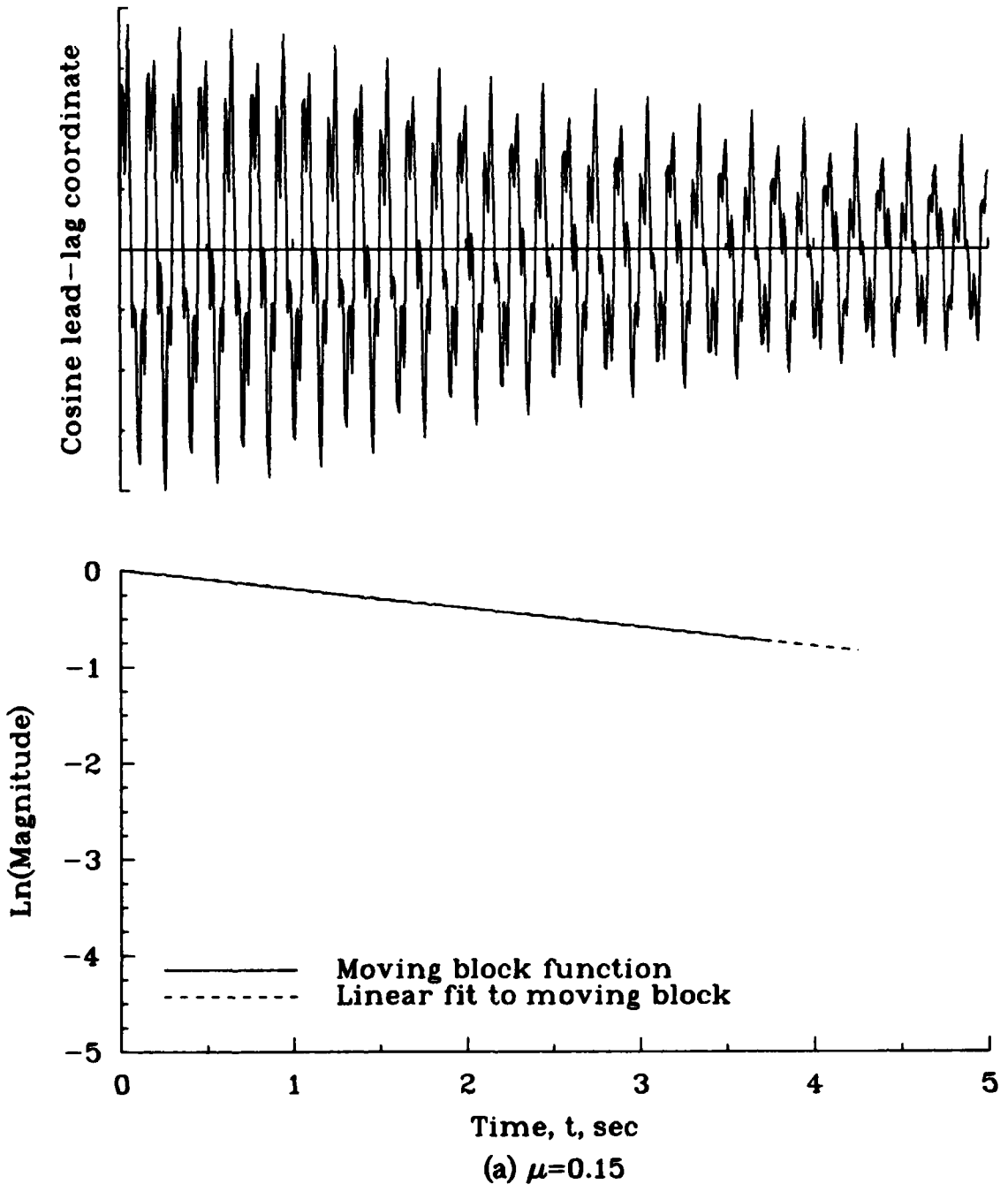
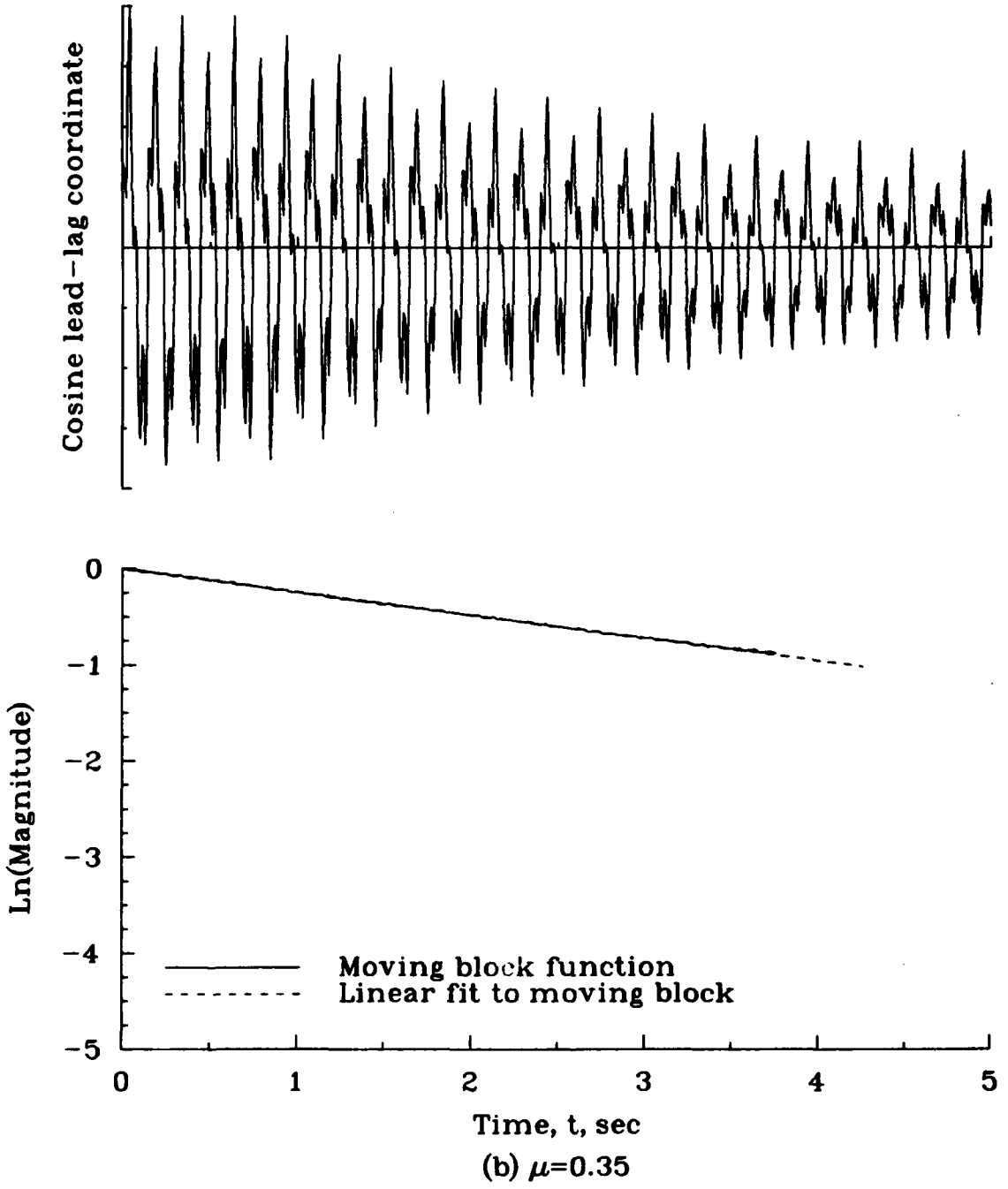
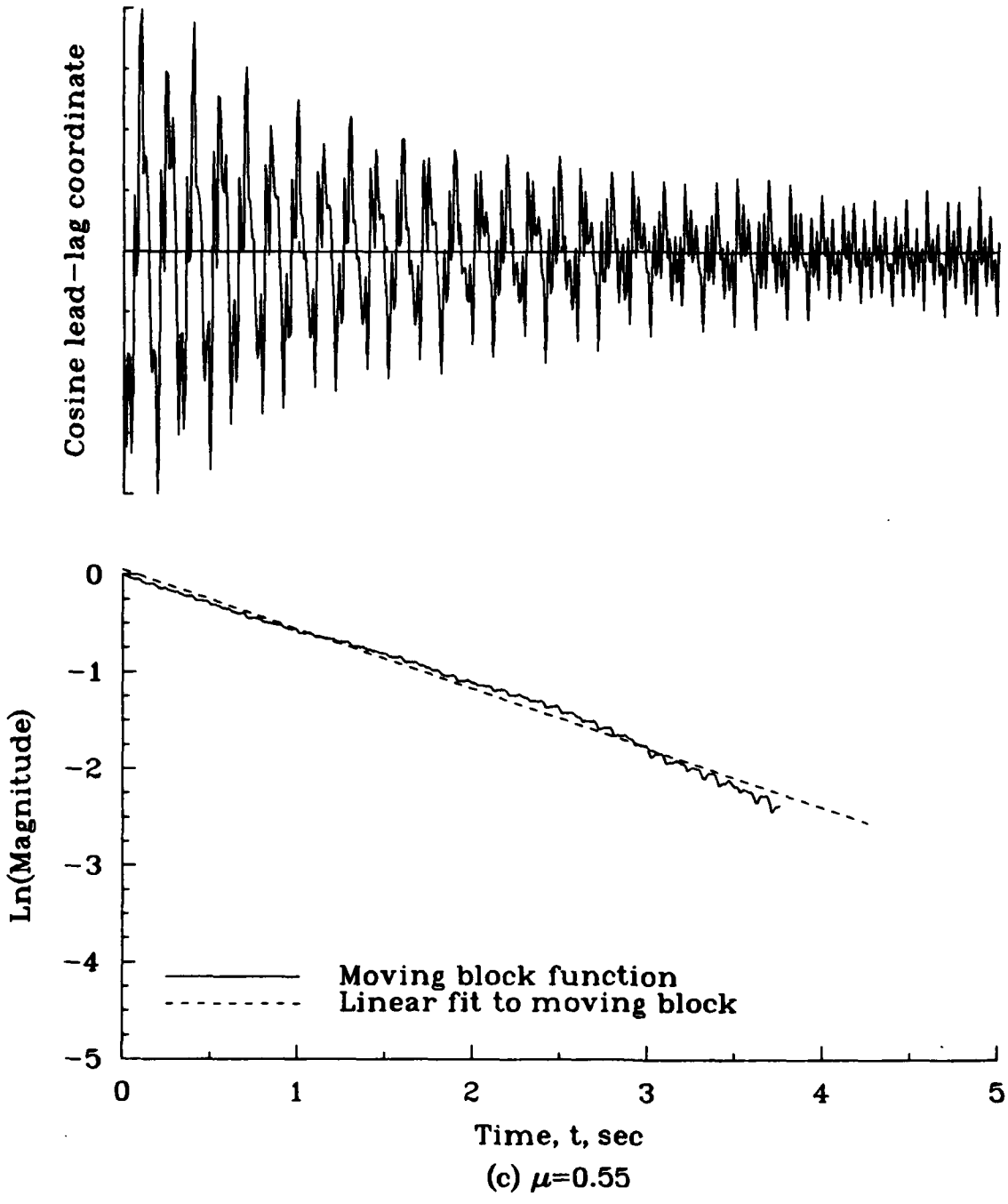


Figure 34.–Representative transient time histories in forward flight and their moving-block functions at the regressing lead-lag mode frequency; configuration without flap-lag structural coupling; $\theta_0 = 0°$, 1000 rpm, $\alpha_s = -10°$.



(b) μ=0.35

Figure 34.–Continued.



(c) μ=0.55

Figure 34.–Concluded.

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16. Abstract

An isolated, hingeless rotor with discrete flap and lead-lag flexures and relatively rigid blades was tested in the Aeroflightdynamics Directorate's 7- by 10-Foot Wind Tunnel. The purpose of the test was to determine experimentally the lead-lag stability of a structurally simple rotor configuration in forward flight. The model tested had no cyclic pitch control, and was therefore operated untrimmed at several collective pitch angles, at shaft angles from 0° to –20°, and at advance ratios as high as 0.55. Two inplane natural frequencies, 0.61/rev and 0.72/rev, were tested for configuration both with and without structural flap lag coupling. Concomitant hover testing of the model was also conducted. Representative plots of the frequency and damping data are presented to show general trends, and complete tabular data and model properties information are included for use in detailed correlation exercises. The most prominent feature of the forward flight data is an abrupt increase in damping with advance ratio at certain high-speed, high shaft-angle conditions, with high flapping loads. The hover data are consistent with previous experimental and theoretical results for hingeless rotors without kinematic couplings. Overall, the data quality is very good and the data are expected to be useful in the development and validation of rotor aeroelastic stability analyses.

(25)

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